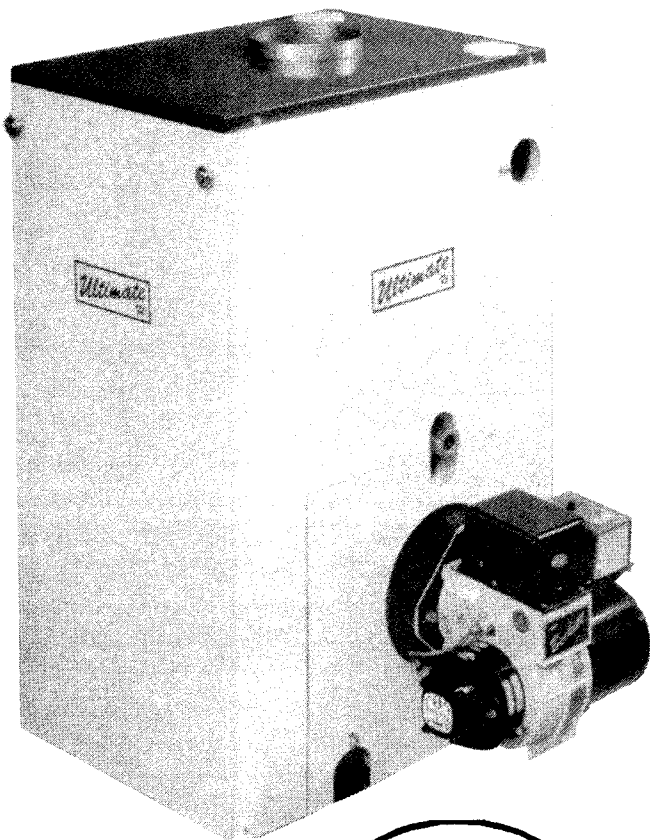


ULTIMATE®

MVP of Versatility! The ULTIMATE Boiler

PRESSURE FIRED HIGH EFFICIENCY CAST-IRON WET-BASE BOILER



- **Installation**
- **Operation**
- **Repair Parts**

PF SERIES



This pressure fired boiler can be:

- chimney vented
- through the wall vented
- fired with oil or gas
- installed indoors or outdoors



These instructions must be affixed on or adjacent to the boiler.

ULTIMATE ENGINEERING

A DIVISION OF DUNKIRK BOILERS

DUNKIRK, NEW YORK 14048 • (716) 366-5500

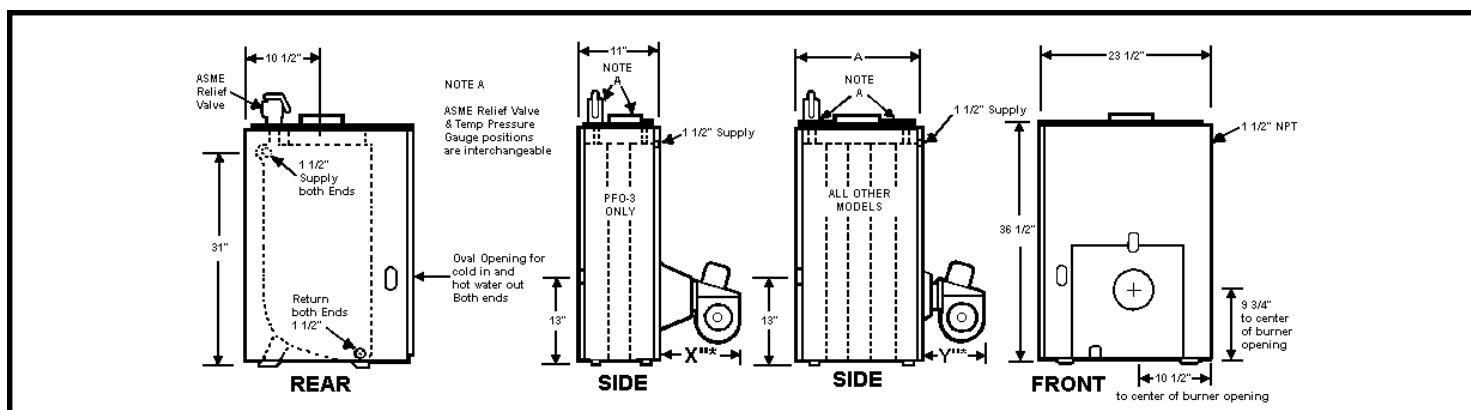
MEMBER: The Hydronics Institute

Table of Contents

BOILER RATINGS AND CAPACITIES	
Indoor Oil-Fired Boilers	1
Indoor Gas-Fired Boilers	2
Weatherproof Oil-Fired Boilers	3
Weatherproof Gas-Fired Boilers	4
RULES FOR SAFE INSTALLATION AND OPERATION	
BEFORE YOU START	5
INSTALLATION REQUIREMENTS	6
INDOOR BOILER INSTALLATION INSTRUCTIONS	
Locating the Boiler	7
Fresh Air for Combustion – Chimney Vented Boilers	8
Jacket Assembly Instructions	9
Flue Connections – Chimney Vented	10
Flue Connections – Direct Exhaust	12
System Piping	14
Oil Burner and Controls – Start-Up and Adjustment	
Chimney Vented	15
Direct Exhaust	17
Gas Burner and Controls – Start-Up and Adjustment	19
WEATHERPROOF BOILER INSTALLATION INSTRUCTIONS	
Locating the Boiler	22
Assembly and Piping – Space Heating Only	22
Assembly and Piping – Pool Heating Only	23
Oil Burner and Controls – Start-Up and Adjustments	26
Gas Burner and Controls – Start-Up and Adjustments	28
MAINTENANCE	30
BOILER CLEANING INSTRUCTIONS	32
SERVICE HINTS	33
REPAIR PARTS	34

Boiler Ratings and Capacities

FIG. 1 - INDOOR BOILERS



BURNER TYPE	AFG - OIL	CF375 - OIL	AFG W/AIR INTAKE BOOT	G2T - GAS	RIELLO 40 SERIES - OIL
X	11½	14	18	13½	16 ⁷ / ₈
Y	8½	11	15	10½	13 ⁷ / ₁₆

INDOOR OIL-FIRED HOT WATER BOILERS

MODELS LESS TANKLESS COIL								
MODEL	RECOMMENDED FIRING RATES GPH	HEATING CAPACITY MBH	NET I=B=R RATING MBH	ANNUAL FUEL UTILIZATION EFFICIENCY%	STEADY STATE EFFICIENCY %	NO. SEC.	FLUE SIZE	LENGTH "A" DIMENSION
PFO-3	Minimum .45	Note 1 56	Note 2 48	Note 3 87.5	88.22	3	5"	11"
	Maximum .90	105	91	82.8	83.19	3	5"	11"
PFO-4	Minimum .60	74	64	87.5	88.23	4	6"	14¼"
	Maximum 1.35	159	138	83.3	83.91	4	6"	14¼"
PFO-5	Minimum .75	93	81	87.5	88.23	5	6"	17½"
	Maximum 1.70	199	173	83.9	84.63	5	6"	17½"
PFO-7	Minimum 1.05	130	113	87.6	88.24	7	7"	24"
	Maximum 2.35	276	240	**	**	7	7"	24"
PFO-9	Minimum 1.35	167	146	87.6	88.26	9	8"	30½"
	Maximum 3.00	353	307	**	**	9	8"	30½"

MODELS WITH TANKLESS COIL								
MODEL	RECOMMENDED FIRING RATES GPH	HEATING CAPACITY MBH	NET I=B=R RATING MBH	ANNUAL FUEL UTILIZATION EFFICIENCY%	STEADY STATE EFFICIENCY %	NO. SEC.	FLUE SIZE	LENGTH "A" DIMENSION
PFO-3T	Minimum .50	Note 1 62	Note 2 54	Note 3 87.6	88.40	3	6"	14¼"
	Maximum 1.10	129	112	82.9	83.77	3	6"	14¼"
PFO-4T	Minimum .65	80	70	87.5	88.35	4	6"	17½"
	Maximum 1.45	169	147	83.3	84.24	4	6"	17½"
PFO-5T	Minimum .80	99	86	87.5	88.31	5	7"	20¾"
	Maximum 1.75	208	182	83.8	84.72	5	7"	20¾"
PFO-6T	Minimum .95	117	102	87.5	88.26	6	7"	24"
	Maximum 2.10	250	217	84.3	85.20	6	7"	24"
PFO-8T	Minimum 1.25	154	134	87.4	88.15	8	8"	30½"
	Maximum 2.75	324	282	**	**	8	8"	30½"

** Capacity greater than that requiring testing under F.T.C. regulations

Firing rates of 2.00 gph or less use a Beckett Model AFG oil burner. Firing rates over 2.00 gph use a Beckett Model CF375 oil burner. Optional Riello 40 series oil burners also available.

★As an Energy Star Partner, Dunkirk Radiator Corporation has determined that this product meets the Energy Star guidelines for Energy Efficiency.

INDOOR GAS-FIRED HOT WATER BOILERS

MODELS LESS TANKLESS COIL								
MODEL	RECOMMENDED FIRING RATES MBH	HEATING CAPACITY MBH	NET I=B=R RATING MBH	ANNUAL FUEL UTILIZATION EFFICIENCY %	STEADY STATE EFFICIENCY %	NO. SEC.	FLUE* SIZE	LENGTH "A" DIMENSION
PFG-3	Minimum 63	Note 1 54	Note 2 47	Note 3 84.7	85.73	3	5"	11"
	Maximum 126	104	90	81.6	82.19	3	5"	11"
PFG-4	Minimum 84	72	63	84.8	85.70	4	6"	14 1/4"
	Maximum 189	156	136	81.9	82.45	4	6"	14 1/4"
PFG-5	Minimum 105	90	78	84.8	85.67	5	6"	17 1/2"
	Maximum 211	175	152	82.1	82.71	5	6"	17 1/2"
PFG-7	Minimum 147	126	109	84.9	85.61	7	7"	24"
	Maximum 240	200	174	82.5	83.23	7	7"	24"
PFG-9	Minimum 189	162	141	84.9	85.55	9	8"	30 1/2"
	Maximum 240	201	175	83.0	83.75	9	8"	30 1/2"

MODELS WITH TANKLESS COIL								
MODEL	RECOMMENDED FIRING RATES MBH	HEATING CAPACITY MBH	NET I=B=R RATING MBH	ANNUAL FUEL UTILIZATION EFFICIENCY %	STEADY STATE EFFICIENCY %	NO. SEC.	FLUE* SIZE	LENGTH "A" DIMENSION
PFG-3T	Minimum 70	Note 1 60	Note 2 52	Note 3 85.0	85.73	3	6"	14 1/4"
	Maximum 154	127	110	81.5	82.18	3	6"	14 1/4"
PFG-4T	Minimum 91	78	68	85.0	85.68	4	6"	17 1/2"
	Maximum 183	151	131	81.8	82.46	4	6"	17 1/2"
PFG-5T	Minimum 112	96	83	85.0	85.64	5	7"	20 3/4"
	Maximum 212	175	153	82.1	82.75	5	7"	20 3/4"
PFG-6T	Minimum 133	114	99	85.0	85.60	6	7"	24"
	Maximum 240	199	173	82.4	83.04	6	7"	24"
PFG-8T	Minimum 175	150	130	85.0	85.52	8	8"	30 1/2"
	Maximum 240	201	175	82.9	83.62	8	8"	30 1/2"

★ As an Energy Star Partner, Dunkirk Radiator has determined that this product meets the Energy Star guidelines for Energy Efficiency.

NOTES

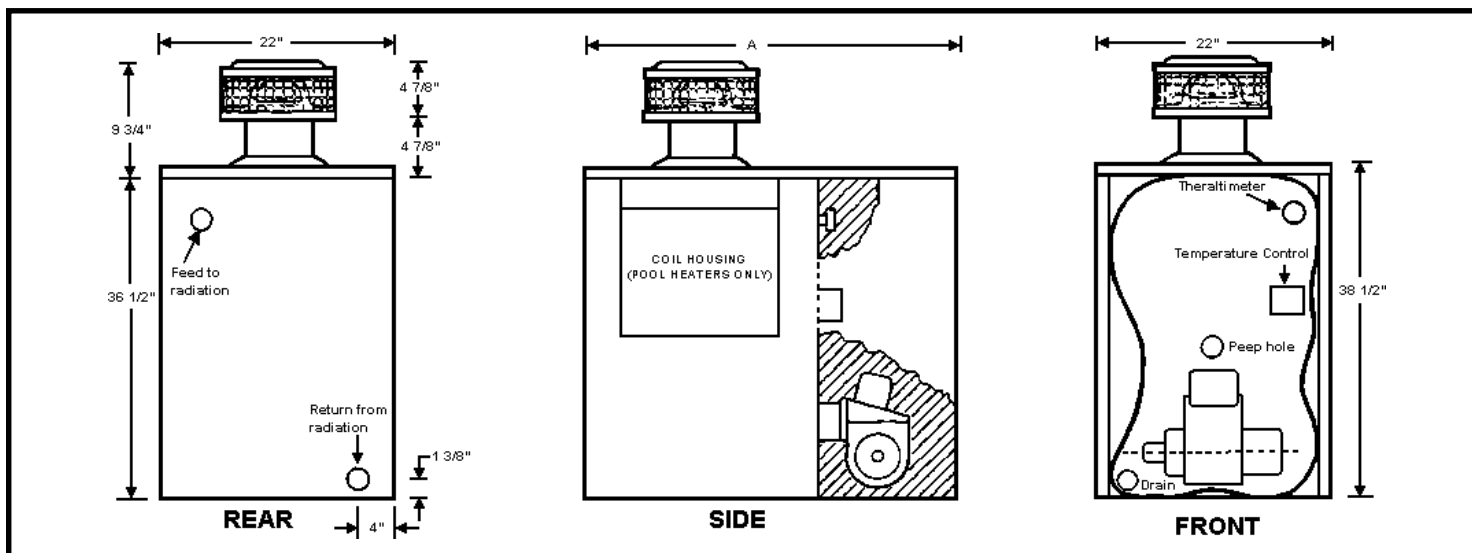
Note 1: D.O.E. Heating capacity is indicated in thousands of Btu per hour. Use of antifreeze in any boiler can reduce capacity, net output and efficiency by a significant amount.

Note 2: Net ratings are indicated in thousands of Btu per hour based on a piping and pickup allowance of 1.15.

Note 3: Annual Fuel Utilization Efficiency based on tests performed under U.S. Department of Energy standards and reported to the Federal Trade Commission.

It is strongly recommended that, before selecting a boiler model for a specific installation, the installer familiarize himself with "Proper Venting of High Efficiency Boilers" published by Dunkirk Radiator Corporation.

FIG. 2 - WEATHERPROOF BOILERS



WEATHERPROOF OIL BOILERS

SPACE HEATERS LESS COIL								
MODEL	RECOMMENDED FIRING RATES GPH	HEATING CAPACITY MBH	NET I=B=R RATING MBH	ANNUAL FUEL UTILIZATION EFFICIENCY%	STEADY STATE EFFICIENCY %	NO. SEC.	MULTI-PASS COIL	LENGTH "A" DIMENSION
PFO-3T2W	Minimum .50 Maximum 1.10	Note 1 59 123	Note 2 51 107	Note 3 82.9 78.2	88.40 83.77	3	One	28 ¹ / ₈ "
PFO-6T2W	Minimum .95 Maximum 2.10 †	112 239	97 208	82.8 79.6	88.25 85.20	6	One	37 ⁷ / ₈ "
PFO-7TT2W	Minimum 1.10 Maximum 2.50 †	129 294	112 256	82.4 *	88.22 *	7	Two	44 ³ / ₈ "
PFO-8T2W	Minimum 1.25 Maximum 2.75 †	147 309	128 268	82.7 *	88.15 *	8	One	44 ³ / ₈ "

SPACE HEATERS LESS COIL								
MODEL	RECOMMENDED FIRING RATES GPH	HEATING CAPACITY MBH	NET I=B=R RATING MBH	ANNUAL FUEL UTILIZATION EFFICIENCY%	STEADY STATE EFFICIENCY %	NO. SEC.	MULTI-PASS COIL	LENGTH "A" DIMENSION
PFO-4W	Minimum .60 Maximum 1.35	Note 1 71 151	Note 2 61 131	Note 3 82.9 78.6	88.23 83.19	4	Less	28 ¹ / ₈ "
PFO-7W	Minimum 1.05 Maximum 2.35	124 276	107 240	82.9 *	88.24 *	7	Less	37 ⁷ / ₈ "
PFO-9W	Minimum 1.35 Maximum 3.00	159 309	138 268	82.5 *	88.26 *	9	Less	44 ³ / ₈ "

* Capacity greater than that requiring testing under F.T.C. regulations.

† For firing rates above 2.00 GPH, consult factory concerning pumping requirements for pool heating

Firing rates of 2.00 gph or less use a Beckett Model AFG oil burner. Firing rates over 2.00 gph use a Beckett Model CF375 oil burner.

WEATHERPROOF GAS BOILERS

POOL HEATERS WITH HEAT EXCHANGE COILS								
MODEL	RECOMMENDED FIRING RATES MBH	HEATING CAPACITY MBH	NET I=B=R RATING MBH	ANNUAL FUEL UTILIZATION EFFICIENCY %	STEADY STATE EFFICIENCY %	NO. SEC.	DOUBLE PASS COIL	LENGTH "A" DIMENSION
PFG-3T2W	Minimum 70 Maximum 95	Note 1 59 77	Note 2 51 67	Note 3 81.0 80.0	85.7 84.6	3	One	28 ¹ / ₈ "
PFG-6T2W	Minimum 133 Maximum 175	110 143	96 124	81.0 80.0	85.6 84.9	6	One	37 ¹ / ₈ "
PFG-7TT2W	Minimum 154 Maximum 204	128 166	111 144	81.0 80.0	85.5 84.4	7	Two	44 ³ / ₈ "
PFG-8T2W	Minimum 175 Maximum 240	145 197	126 171	81.0 80.0	85.5 85.1	8	One	44 ³ / ₈ "

SPACE HEATERS LESS COIL								
MODEL	RECOMMENDED FIRING RATES MBH	HEATING CAPACITY MBH	NET I=B=R RATING MBH	ANNUAL FUEL UTILIZATION EFFICIENCY %	STEADY STATE EFFICIENCY %	NO. SEC.	DOUBLE PASS COIL	LENGTH "A" DIMENSION
PFG-4W	Minimum 84 Maximum 115	Note 1 70 93	Note 2 61 81	Note 3 80.8 80.2	85.7 84.7	4	Less	28 ¹ / ₈ "
PFG-7W	Minimum 147 Maximum 183	122 149	106 130	80.9 80.0	85.6 85.0	7	Less	37 ¹ / ₈ "
PFG-9W	Minimum 189 Maximum 240	156 198	136 172	80.9 80.4	85.5 85.1	9	Less	44 ³ / ₈ "

IMPORTANT: ANTIFREEZE ADDED TO WEATHERPROOF BOILERS MUST BE NON-TOXIC.

NOTES

- Note 1:** D.O.E. Heating capacity is indicated in thousands of Btu per hour. Use of antifreeze in any boiler may reduce capacity, net output and efficiency by a significant amount.
- Note 2:** Net ratings are indicated in thousands of Btu per hour based on a piping and pickup allowance of 1.15.
- Note 3:** Annual Fuel Utilization Efficiency based on tests performed under U.S. Department of Energy standards and reported to the Federal Trade Commission.

OPTIONAL DIRECT EXHAUST SYSTEM (DES)

The optional DES is ETL listed to be used in conjunction with the PF boiler for indoor installations requiring through the wall venting. The DES is designed as an integral part of the PF boiler, eliminating the need for a power venter.

1. Oil-Fired Boilers

Firing rate 1.00 gph or less uses kit DES-4AW.
 Firing rate over 1.00 gph and 2.00 gph or less uses kit DES-6AW.
 Firing rate over 2.00 gph uses kit DES-6SW.
 Oil boiler DES kits include an oil burner with adjustable post purge timer and solenoid valve. For through the wall venting, this post purge burner must be used in place of the standard burner that is furnished with the boiler.

2. Gas-Fired Boilers

Firing rate 140 MBH or less uses kit DES-4GL.

Firing rate greater than 140 MBH used kit DES-6GL.

Gas boiler DES kits do not include a burner. The standard G2T burner furnished with the boiler is also used for through the wall venting. Gas-fired direct exhaust systems do not require post purge or additional solenoid valves.

SELECTION OF BOILER SIZE

Selection of boiler size should be based upon the "Net I=B=R Rating MBH" being equal to or greater than the calculated heat loss of the building.

These boilers are low pressure sectional cast iron boilers constructed and hydrostatically tested for a maximum working pressure of 50 psi in accordance with A.S.M.E. (American Society of Mechanical Engineers) Section IV Standards for cast iron heating boilers. They are capacity rated in accordance with the code of the Hydronics Institute. These boilers operate on #2 Heating Oil, Natural Gas, or Propane Gas, with the proper burner.

IMPORTANT—

Standard indoor PF Series boilers are furnished as knock-down boilers, and are shipped as four components (w/o DES) or five components (with DES) as shown below.

1. Basic Boiler Assembly (Oil and Gas identical)
2. Boiler Jacket (Oil and Gas identical)
3. Accessory Kit (Oil and Gas identical)
4. Burner (Oil or Gas, without Post Purge)
5. DES parts (includes Post Purge oil burner for oil-fired boilers)

Weatherproof (outdoor) PF Series boilers are furnished as knockdown boilers only, and are shipped as five (space heating) or six (pool heating) components as shown below.

1. Basic Boiler Assembly (Oil and Gas identical)
2. Weatherproof Boiler Jacket (Oil and Gas identical)
3. Exhaust Cap, Pipe and Weather Collar (Oil and Gas identical)

4. Accessory Kit (Oil and Gas identical)
5. Burner (Oil or Gas)
6. Coil Housing (Pool Heating only)

On knockdown oil boilers, the oil burner nozzle is not included. Correctly sized nozzle must be installed prior to start-up.

Indoor oil-fired Models PFO-(3, 4, 5, 3T, 4T, 5T) without direct exhaust system are available as packaged boilers, in which case an oil burner nozzle for one of three specified firing rates will be factory installed in the oil burner.

Gas boilers, knockdown or packaged, may be ordered to have their burners equipped for either natural or propane gas with the proper flame retention head and orifice to match the input specified by the purchaser. However a boiler drawn from the stock of a wholesale distributor will normally be equipped with a burner with a G-O flame retention head and an orifice to fire natural gas in the minimum input range of a G-O head.

Rules for Safe Installation and Operation

1. Read the Installation Manual before beginning the installation. Failure to follow the rules for safe operation and the instructions can cause a malfunction of the boiler and result in death, serious bodily injury, and/or property damage.
2. Check your local codes and utility requirements before installation. The installation must be in accordance with their directives, or in their absence, follow NFPA Installation Codes and good industry practice.
3. Before servicing, allow boiler to cool. Always shut off any electricity and oil to boiler when working on it. This will prevent any electrical shocks or burns.
4. Inspect oil line and connections for leaks.
5. Be certain oil burner nozzle or gas orifice is size required. Overfiring will result in early failure of the boiler sections. This will cause dangerous operation.
6. Never vent this boiler into an enclosed space. Always vent to the outside. Never vent to another room or inside a building.
7. Be sure there is adequate air supply for complete combustion.
8. Follow a regular service and maintenance schedule for efficient and safe operation.
9. Keep boiler area clean and free of combustible material, gasoline and other flammable vapors and liquids.
10. Proper through the wall venting requires use of complete DES.
11. Oil and gas burners are not do-it yourself items. This boiler must be installed and serviced by qualified professionals using combustion test instruments.
12. Be aware when piping the relief valve if the system pressure exceeds the safe limit of 30 pounds per square inch, the relief valve will automatically open. Lifting of the relief valve can discharge large quantities of steam and hot water, which may damage the surroundings. Before installing the relief valve read the manufacturer's instructions and the maintenance section of the manual on relief valves.
13. Frequent and mysterious lifting of the relief valve may be a sign of an improperly sized expansion tank. Installation and sizing of the expansion tank must consider the heating systems total water volume, temperature, boiler initial fill pressure, and system arrangement. For proper installation and maintenance follow the guidelines established by Dunkirk Radiator Corporation and the manufacturer.
14. Expansion tank performance and life expectancy can be hindered by overfilling the boiler. Dunkirk Radiator recommends an initial fill pressure of 10-12 psig. For higher fill pressures the expansion tank's air charge will need to match the fill pressure. Consult the manufacturer's guidelines for sizing and selection.
15. Purging the heating system of air and gases during the boiler's initial commissioning is critical for proper circulation and quiet performance. Once the air and gases are purged, for boiler installations using float type vents, the air vents should be closed for normal operation. If air is heard or noticed by a loss of heat, purge the system and open the vents for a short period of time.

WARNING

This boiler has been designed for residential installations. If used for commercial applications, all jurisdictional requirements must be met. This may require wiring and/or piping modifications. The manufacturer is not responsible for any changes to the original design.

DO NOT USE GASOLINE CRACKCASE DRAININGS OR ANY OIL CONTAINING GASOLINE.

Before You Start

Check to be sure you have the right size boiler before starting the installation. See rating and capacity table on preceding pages. Check the rating plate on the right side of the boiler.

You must see that the boiler is supplied with the proper fuel, fresh air for combustion, and a suitable electrical supply. Also, the boiler must be connected to a suitable venting system and an adequate piping system. Finally, a

thermostat, properly located, is needed for control of the heating system. If you have any doubts as to the various requirements, check with local authorities and obtain professional help where needed.

These INSTALLATION INSTRUCTIONS are vital to the proper and safe operation of the heating system. Take the time to be sure they are carefully followed.

ALWAYS KEEP THE MANUAL FUEL SUPPLY VALVE SHUT OFF, IF THE BURNER IS SHUT DOWN FOR AN EXTENDED PERIOD OF TIME.

THE PUMP PRESSURE OF THE STANDARD BECKETT BURNER IS SET AT 140 PSI

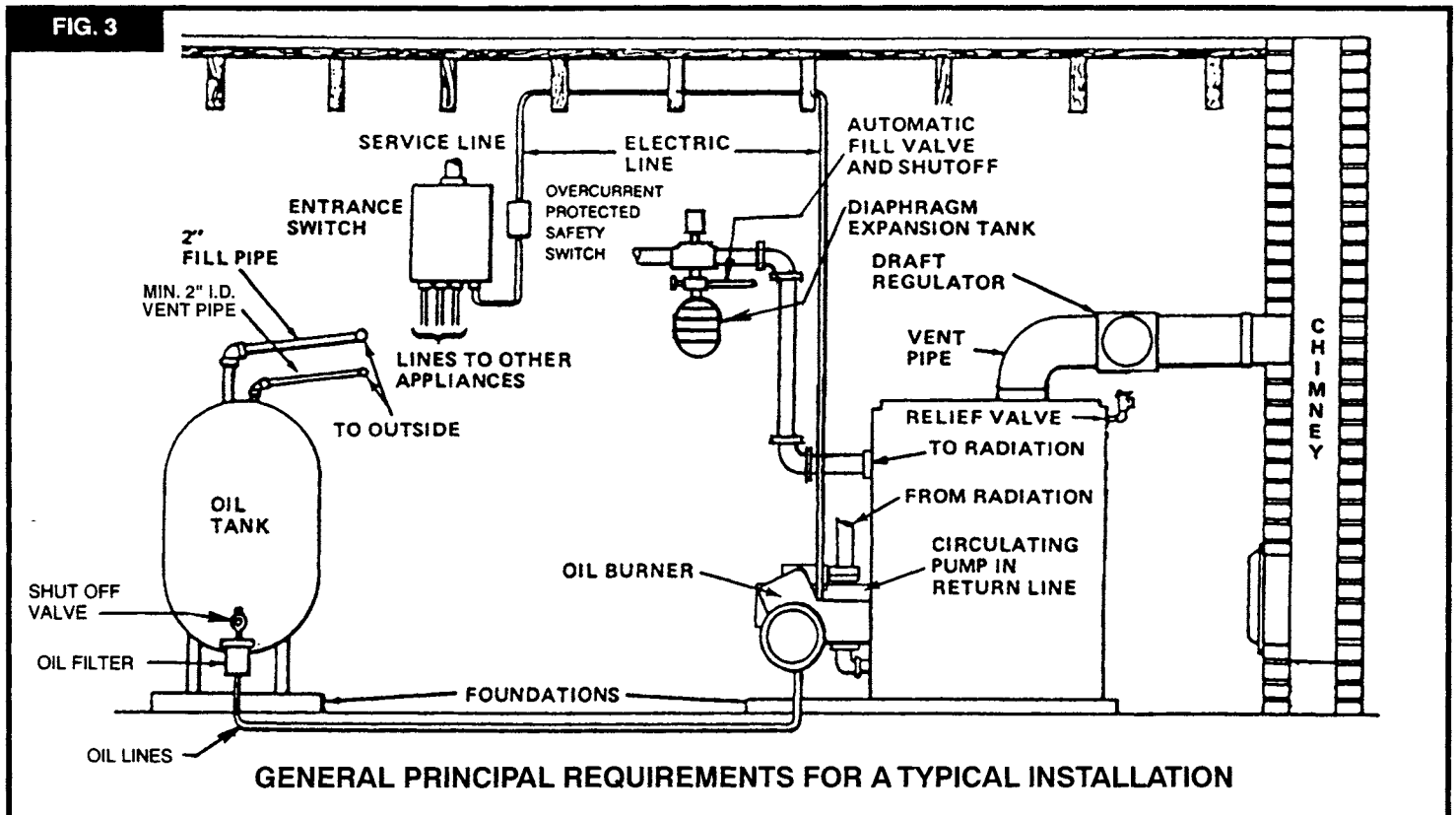
The output of the burner nozzle will be 18% greater than it is rated.

Rated Output (gph) at 100 psi (nozzle label)	Actual Output (gph) at 140 psi (approximate)
.40	.47
.50	.59
.60	.71
.65	.77
.75	.89
.85	1.01
1.00	1.18
1.10	1.30
1.20	1.42

Rated Output (gph) at 100 psi (nozzle label)	Actual Output (gph) at 140 psi (approximate)
1.25	1.48
1.35	1.60
1.50	1.77
1.65	1.95
1.75	2.07
2.00	2.37
2.25	2.66
2.50	2.96

Installation Requirements

FIG. 3



Indoor Boiler Installation Instructions

Locating the Boiler

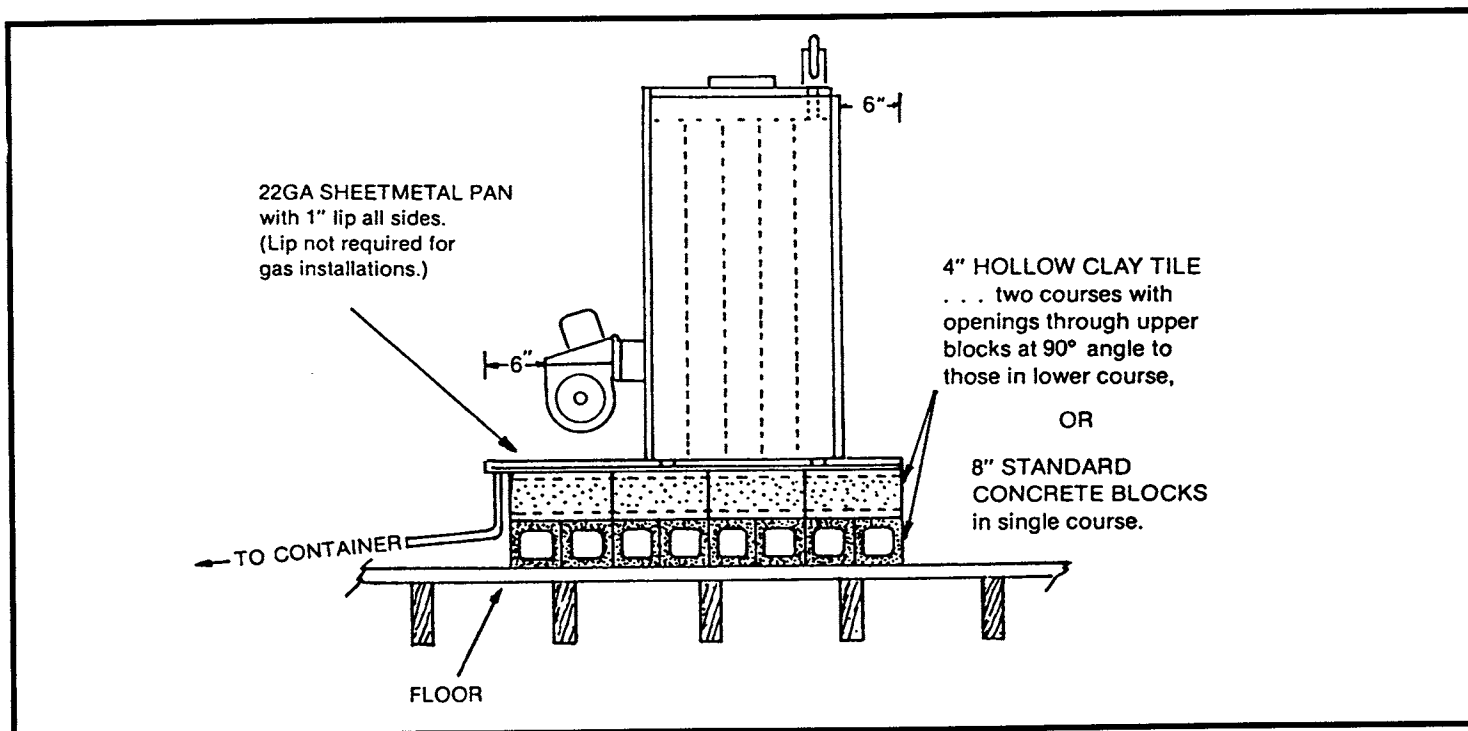
NOTE: Please see page 10 for flue size limitation and other information on venting. For direct exhaust systems, the total run of horizontal flue pipe must not exceed 6'.

1. Place boiler at a location as centralized with the piping system and as **close** to the chimney or vent terminal as possible to minimize condensation. At input rates up to 1.75 gph (245,000 Btu/hr), the supply and return from radiation may be piped on the same end of the boiler. At higher rates it is recommended that the supply be piped from the rear of the boiler and the return be piped from the front of the boiler. **Coordinate jacket installation with piping.** See page 9 for Jacket Assembly instructions. See page 14 for piping diagrams.

2. See Figure 4 for installation on combustible flooring.
3. If necessary, place metal shims beneath feet to ensure a level unit.
4. Accessibility clearances must take precedence over fire protection clearances. Allow at least 24" for servicing at the tankless and burner sides of the unit. Allow at least 18" at a side where passage is required for access to another side for servicing. A 6" clearance from combustible material on all sides and the top is recommended. 18" clearance is necessary between smoke pipe and nearest combustible material. See NFPA 31, latest revision, for safe methods to reduce clearances where necessary. NFPA publications are available at Batterymarch Park, Quincy, MA 02269.

FIG. 4 – RECOMMENDED FIREPROOF BASE FOR INSTALLATION ON COMBUSTIBLE FLOORING

CONSULT FIRE AUTHORITIES FOR LOCAL REQUIREMENTS



NOTE: The above recommendations in regard to clay or concrete blocks exceed the requirements of the National Fire Protection Association as follows:

N.F.P.A. 31 Section 4-4.1.5 Appliances may be placed on combustible floors, although not listed for such installation, provided the floor under the appliance is protected in accordance with the requirements of accepted building code practice. (A water-wall-type heating boiler operating

not in excess of 250° F for water boilers) may be placed on a combustible floor protected with hollow masonry not less than 4" (100mm) thick covered with sheet metal not less than 24 gauge. Such masonry shall be laid with ends unsealed and joints matched in such a way as to permit free circulation of air from side to side through the masonry.

Fresh Air for Combustion - Chimney Vented Boilers

WARNING

Be sure to provide enough fresh air for combustion. Enough air ensures proper combustion and **assures that no hazard will develop due to the lack of oxygen.**

You must provide for enough fresh air to assure proper combustion. The fire in the boiler uses oxygen. It must have a continuous supply. The air in a house contains only enough oxygen to supply the burner for a short time. Outside air must enter the house to replace that used by the burner. Study following examples 1 and 2 to determine your fresh air requirements.

EXAMPLE 1: Boiler Located in Unconfined Space

If your boiler is in an open area (unpartitioned basement) in a conventional house, the air that leaks through the cracks around doors and windows will usually be adequate to provide air for combustion. The doors should not fit tightly. Do not caulk the cracks around the windows.

An unconfined space is defined as a space whose volume is not less than 50 cubic feet per 1,000 Btu per hour of the total input rating of all appliances installed in the space.

EXAMPLE 2: Boiler Located in Confined Space

A. **All Air from Inside the Building:** The confined space shall be provided with two permanent openings communicating directly with an additional room(s) of sufficient volume so that the combined volume of all spaces meets the criteria for an unconfined space. The total input of all combustion equipment installed in the combined space shall be considered in making this determination. Each opening shall have a minimum free area of one square inch per 1,000 Btu per hour of the total input rating of all combustion equipment in the confined space, but not less than 100 square inches. One opening shall be within 12 inches of the top and one within 12 inches of the bottom of the enclosure. See Figure 5.

Example: Your boiler is rated at 100,000 Btu per hour. The water heater is rated at 30,000 Btu per hour. The total is 130,000 Btu per hour. You need two grilles, each with 130 square inches of FREE opening. Metal grilles have about 60% FREE area. To find the louvered area needed, multiply the FREE area required by 1.7 ($130 \times 1.7 = 221.0$ sq. in. louvered area). In this example two grilles, each having an 8" x 30" (240 sq. in.) louvered area would be used. Fig. 5 shows the grille locations.

B. **All Air from Outdoors:** The confined space shall be provided with two permanent openings, one commencing within 12 inches of the top and one commencing within 12 inches of the bottom of the enclosure. The openings shall communicate directly, or by ducts, with the outdoors or spaces (crawl or attic) that freely communicate with the outdoors.

1. When directly communicating with the outdoors, each opening shall have a minimum free area of one square inch per 4,000 Btu per hour of total input rating of all equipment in the enclosure.

2. When communicating with the outdoors through vertical ducts, each opening shall have a minimum free area of one square inch per 4,000 Btu per hour of total input rating of all equipment in the enclosure.

NOTE

If you use a fireplace or a kitchen or bathroom exhaust fan, you should install an outside air intake. These devices will rob the boiler and water heater of combustion air.

3. When communicating with the outdoors through horizontal ducts, each opening shall have a minimum free area of one square inch per 2,000 Btu per hour of total input rating of all equipment in the enclosure.

4. When ducts are used, they shall be of the same cross-sectional area as the free area of the openings to which they connect. The minimum dimension of rectangular air ducts shall be not less than three inches.

FIG. 5 - AIR OPENINGS FOR CLOSET OR UTILITY ROOM INSTALLATIONS

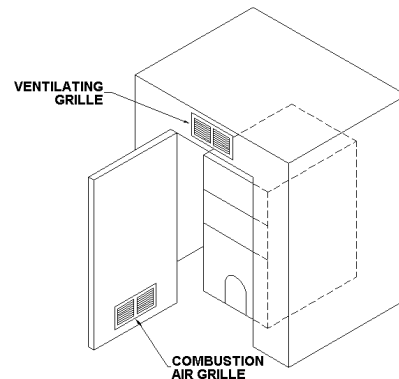


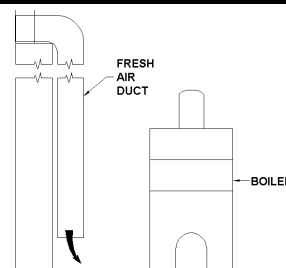
FIG. 6 - FRESH AIR DUCT CAPACITIES

Fresh Air Duct Capacities for Ducts Supplying Fresh Air to boiler in tightly constructed houses. British Thermal Units per hour input (Btuh)*.

Fresh Air Duct Size	1/4" Mesh Screen Btuh	Wood Louvers Btuh	Metal Louvers Btuh
3 1/2" x 12"	144,000	36,000	108,000
8" x 8"	256,000	64,000	192,000
8" x 12"	384,000	96,000	288,000
8" x 16"	512,000	128,000	384,000

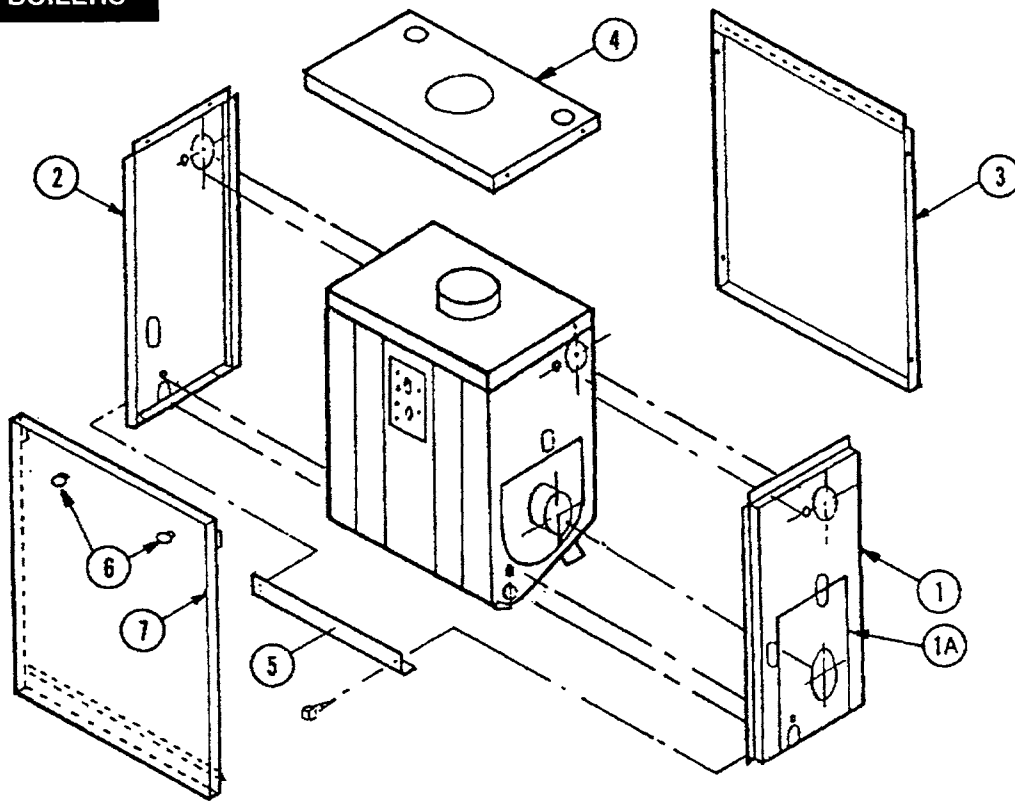
* Based on opening covered by 1/4" mesh screen, wood louvers, or metal louvers

FIG. 7 FRESH AIR DUCT FOR TIGHTLY SEALED HOUSE



Jacket Assembly Instructions

FIG. 8 – INDOOR BOILERS



1. See above diagram for part numbers. Note that all sheet metal screws are #10 unless specified otherwise.
2. See HARDWARE PACKAGE to be found in Boiler Accessory Kit for stand-off bolts, studs, acorn nuts, washers, and $\frac{1}{8}$ " pipe plug. Sight Glass Assembly also to be found in Boiler Accessory Kit.
3. Screw double end stand-off bolts into castings next to upper supply and lower return tapings in both ends of the boiler. Screw three $\frac{5}{16}$ " studs fingertight into burner mounting.
4. Hold Panels 1 and 1A against burner end of boiler and insert necessary piping through jacket openings into boiler casting.
5. Screw acorn nuts onto stand-off bolts.
6. Screw 1" nipple and sight glass holder into hole above burner.
7. Screw the $\frac{1}{8}$ " plug into tapping on upper left of burner mounting.
8. Install Panel No. 2 located at opposite end of boiler in same manner as Panel No. 1.
9. Install Panel No. 3 by attaching it with four sheet metal screws to Panels No. 1 and 2 already in position.
10. Install temperature/pressure gauge into either of the two $\frac{3}{4}$ " tapings on top of casting. Using a $\frac{3}{4}$ " x $4\frac{1}{2}$ " nipple, install relief valve in second top tapping. Install Jacket Top Panel No. 4 by attaching it with four

sheet metal screws to the three jacket side panels already in position.

To permit easy disassembly of overflow pipe in order to raise jacket top panel for annual cleaning, screw **hand tight** a $\frac{3}{4}$ " nipple into the relief valve. Attach a $\frac{3}{4}$ " elbow to the nipple and an overflow pipe to the elbow. (Nipple, elbow and overflow pipe not supplied.) Do not connect directly to a drain, but leave an air gap. No shutoff of any description shall be placed between the safety relief valve and the boiler, or on discharge pipes between such safety valves and the atmosphere. Installation of the safety relief valve shall conform to the ANSI/ASME Boiler and Pressure Vessel Code, Section IV. The manufacturer is not responsible for any water damage.

If preferred, one of the top tapings may be used for an air vent, and the relief valve may be installed in an upper $1\frac{1}{2}$ " side tapping of the casting with a bushing, nipple and street elbow. Valve spindle must be vertical.

11. Install Angle Iron No. 5 **open edge upward** to Panels No. 1 and 2 at the remaining exposed side of the boiler near floor level. Angle Iron is attached with two sheet metal screws to the **inside** of the turned edges of Panels No. 1 and 2.
12. Install Knobs No. 6 on remaining Door Panel No. 7 using #8 machine screws, and install Door Panel No. 7 by resting lower edge inside Angle Iron No. 5 and snapping top sides into place.

Flue Connections

For gas-fired boilers for connections to gas vents or chimneys, vent installations shall be in accordance with Part 7, Venting of Equipment, of the NATIONAL FUEL GAS CODE, ANSI-Z223.1/NFPA-54 – latest revision, and applicable provisions of local building codes. For oil-fired boilers for connections to vents or chimneys, vent installations shall be in accordance with applicable provisions of INSTALLATION OF OIL BURNING EQUIPMENT, NFPA-31 – latest revision, and applicable provisions of local building codes.

INDOOR CHIMNEY VENTED BOILERS

NOTE: If boiler is to be direct exhausted through a wall of the boiler room, please see page 11.

1. The following chart shows recommended minimum chimney sizes based on Table 3 and Figure 6 of the **I=B=R=Testing and Rating Standard for Heating Boilers**, Sixth Edition, June 1989.

RECOMMENDED MINIMUM CHIMNEY SIZES

FIRING RATE (gph)	CHIMNEY HEIGHT (ft)	NOMINAL CHIMNEY AREA	ROUND LINER-INSIDE DIAMETER	SQUARE LINER-INSIDE DIMENSIONS
.60-1.30	15	8" x 8"	6"	6¾" x 6¾"
1.31-1.80	15	8" x 8"	7"	6¾" x 6¾"
1.81-2.00	20	8" x 8"	8"	6¾" x 6¾"
2.10-3.00	20	8" x 12"	10"	6½" x 10½"

For elevations above 2,000 feet above sea level, add 3 feet to chimney heights. Refer to Fig. 11

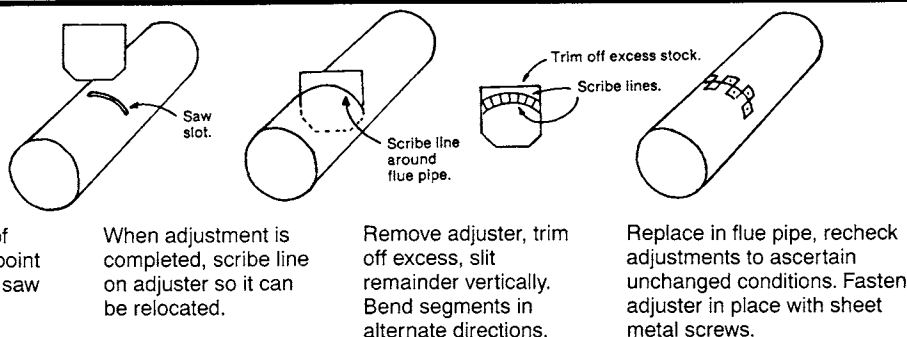
For additional chimney design and sizing information, consult the ASHRAE 1996 HVAC Systems and Applications Handbook, Chapter 30, Chimney, Gas Vent and Fireplace Systems; or the National Standard for Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances, ANSI/NFPA 211.

2. A draft regulator is recommended with or without a neutral pressure point adjustor in all cases where there is chimney draft present. When flue is under positive pressure, such as with a through-the-wall vent, a draft regulator is not used. When a draft regulator is used, it should be the same diameter as the smoke pipe. For gas units a double-acting draft regulator is preferable to a draft diverter. All vent pipe joints and seams operating under positive pressure must be sealed gas tight with minimum 400° F RTV Silicone Rubber Adhesive Sealant.
3. Where draft is present, adjust draft regulator to maintain .01 in breeching. See Figure 9 for instructions on controlling excessive draft by means of a neutral pressure point adjuster.
4. Slope pipe up from boiler to chimney not less than ¼" per foot.
5. Run pipe as directly as possible with a minimum number of elbows.
6. Do not connect to fireplace flue.
7. The end of flue pipe must be flush with the inside face of chimney flue.
8. Support the flue pipe rigidly with substantial hangers plus three sheet metal screws at each pipe joint.
9. The chimney should extend at least two feet above any object within 10 feet and extend at least three feet higher than roof at point of exit.
10. Particular attention should be paid to the point where the flue passes through a wall or ceiling. Such penetration should always be made in accordance with prevailing code requirements.

AVOID EXCESSIVE DRAFT

A neutral pressure point adjuster will reduce excessive draft-regulator air flow which can cause condensation and chimney damage. See below.

FIG. 9



If draft regulator must be more than slightly open to maintain draft at .01 at breeching, a neutral pressure point adjuster should be installed between the boiler flue collar and the draft regulator. Insert adjuster so that draft regulator is not more than slightly open to maintain draft at .01 in breeching. The adjuster should be constructed so that it is

permanently locked in place and cannot be moved accidentally in a manner that will interfere with normal operation of the burner. Do **not** lock adjuster in place until burner firing rate has been established and burner has been adjusted to normal operating conditions..

INDOOR DIRECT EXHAUST BOILERS

IMPORTANT

Consult local authorities to ensure compliance with local building, plumbing and electrical codes.

Use standard single wall galvanized metal vent pipe for the vent and air intake piping.

The **Exhaust Terminal** located on an exterior wall of the building is one of the most important elements of a direct-vent installation. Planning the location of the terminal is the first step. See Figures 10 and 11.

1. Specifications

INPUT (OIL)	INPUT (GAS)	(OIL) DES MODEL	(GAS) DES MODEL	DUCT DIAMETER	WALL OPENING
Thru 1.00 gph Over 1.00 gph	Thru 140 MBH Over 140 MBH	4AW 6AW*	4GL 6GL	4" 6"	6½" 8½"

*Over 2.00 gph use DES kit 6SW.

The exhaust terminal included in the DES kit is a Field Products Model SWH stainless steel vent hood. The model SWH vent hood is designed for use on combustible walls up to 8" thick. For combustible walls over 8" thick, consult the boiler manufacturer. The SWH vent hood may be used on non-combustible walls of any thickness.

2. Location (See Figure 11)

- The exhaust terminal must be positioned so that spent gases will be freely dispersed without re-entering the building.
- It must not be located beneath a porch or crawl space.
- The terminal must be located to permit smoke pipe from the boiler to slope upward not less than ¼" per foot with no more than a 6' horizontal run.
- It must be positioned in correct relationship to the combustion air inlet. See paragraph 6 below.

CAUTION

The importance of the location of the exhaust terminal cannot be over emphasized. The exhaust terminal must be located such that the prevailing winds cause the exhausted flue products to disperse away from the building. A stagnant area where exhaust products can gather, or a wind blowing exhaust products back towards the building may cause undesirable odors to enter the building through any available seams or openings, including the vent itself. Exhaust products blown back towards the building may also cause discoloration of building materials. Under certain conditions, flue gas will condense, forming moisture. In such cases, steps should be taken to prevent building materials at the exhaust terminal from being damaged by exhausted flue gas.

3. Installation (See Figure on page 39)

- Use inside wall end plate as a template to mark hole location. Cut hole 1 inch larger than marked hole to facilitate easy installation.
- Mount furnished 18" x 18" stainless steel plate on the exterior side of the wall with appropriate type mounting screws. Install vent hood through opening from outside. Fasten the vent hood to the stainless steel plate with appropriate type mounting screws. Caulk as necessary.
- Fasten wall end plate to the inside wall with appropriate type mounting screws.

INTAKE AIR is required to support combustion.

- It must enter the same side of building as the exhaust vent in order to balance wind pressure against the flow of gases.

- Bottom of intake duct must be at least 1' above grade level.
- Intake duct and exhaust vent must be not less than 4' apart unless intake is at least 1' below the level of exhaust, in which case the intake may be at a radius of 2' or more from exhaust.
- Provide a 4" wall opening and mount 4" intake duct on a flat surface on exterior of wall in the same manner as the exhaust terminal.
- To supply intake air to the burner:
 - When a Beckett Model AFG oil burner is used, run an air duct of 4" smoke pipe (not supplied) from wall inlet directly to burner intake boot with vacuum relief (draft regulator) installed in duct. Use a 4" wrap-around coupling as provided to connect duct to intake boot.
 - When a Beckett Model SMG oil burner or a gas burner is used, run intake air duct (without vacuum relief) from wall inlet down to an open end approximately 1' from boiler room floor.
 - When a vacuum relief is not used, note that exhaust fans in use might create a vacuum within the building which can cause improper combustion. Consult factory for assistance as required.
 - See Figure 10 for typical installation with Beckett Model AFG post purge oil burner.

EXHAUST FLUE PIPE from boiler must be 6' or less in length in order to minimize condensation.

- Plan flue pipe configuration to ensure easy disassembly for cleaning of boiler interior.
- Using silicone rubber, permanently cement a stub of flue pipe 6" to 12" in length to the boiler flue collector. For ease in later disassembly, use a wrap-around coupling as provided to connect the stub to the next section of flue pipe. Connect the remainder of flue pipe in normal fashion.
- Run flue pipe as directly as possible with minimum number of elbows. Two 45's will cause less resistance than one 90.
- Particular attention should be paid to any point where the flue pipe passes through a wall or ceiling. Such penetrations should always be made in accordance with existing code requirements.
- At reduced flue pipe sizes, do not use more than two 90's or four 45's, and do not reduce pipe to less than:

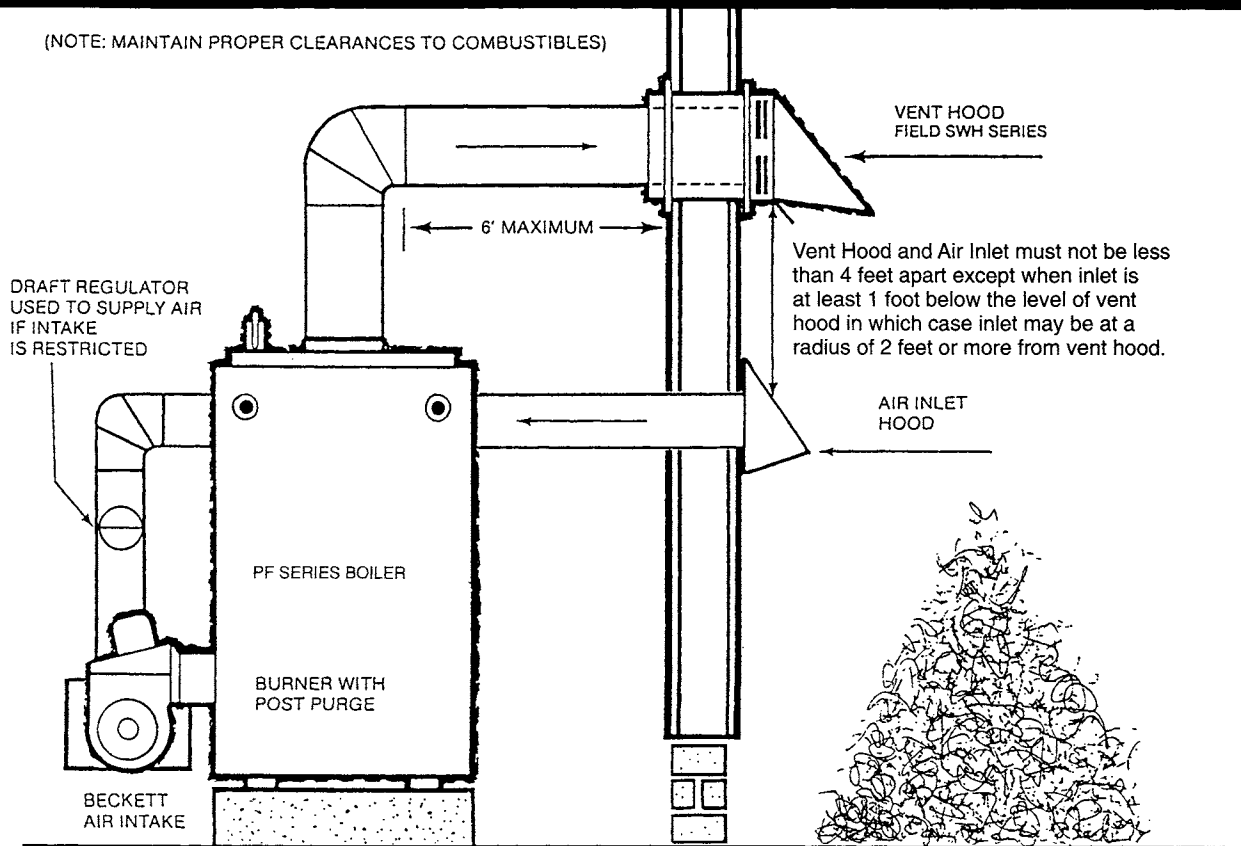
Input (MBH)	Pipe Diameter
To 140	4"
141 to 245	5"
246 to 350	6"
Over 350	8"

Stainless Steel vent terminals (4" and 6") are available from Ultimate. Larger sizes (galvanized) are obtainable from normal sheet metal sources.

- Support flue pipe rigidly with substantial pipe hangers plus three sheet metal screws at each joint.
- Seal pipe joints carefully with minimum 400° F RTV silicone sealant or its equal so that no leakage can be detected by the movement of smoke or a small flame held near the joints with burner in operation.

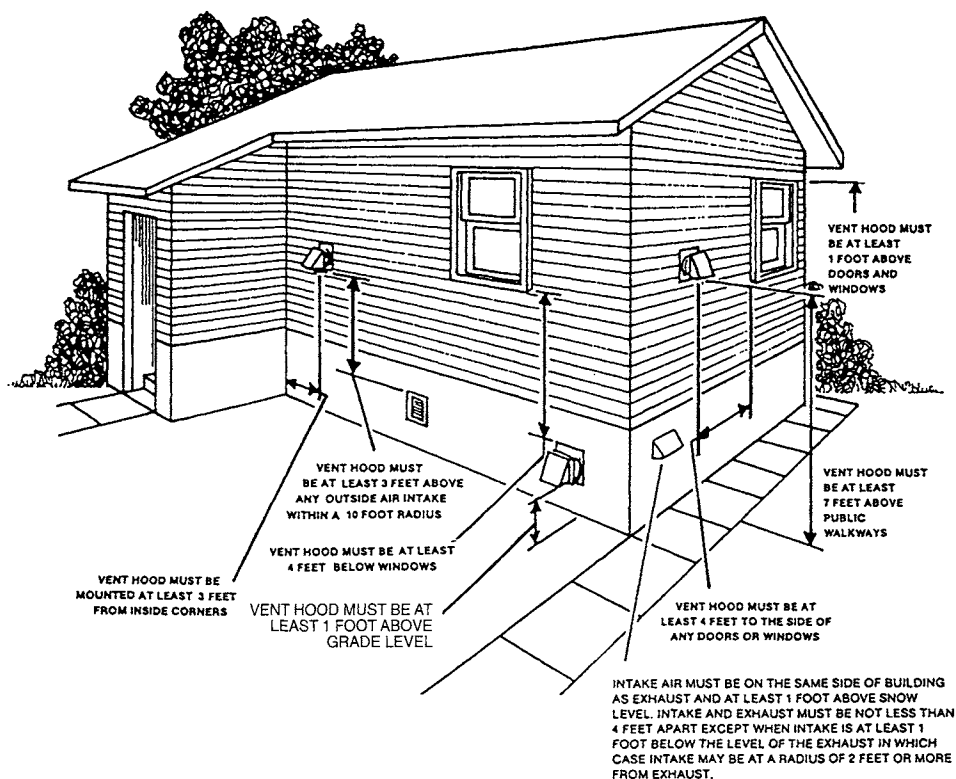
ADVISE OWNER to keep air intake free of obstruction, both indoors and outdoors. Ventilating and combustion air must enter boiler room and burner without restriction.

FIG. 10 – TYPICAL DIRECT EXHAUST INSTALLATION WITH BECKETT AFG OIL BURNER



BOTH VENT AND INLET HOODS MUST BE AT LEAST 1 FOOT ABOVE GRADE LEVEL.

FIG.11 – THROUGH-THE-WALL VENT HOOD LOCATIONS



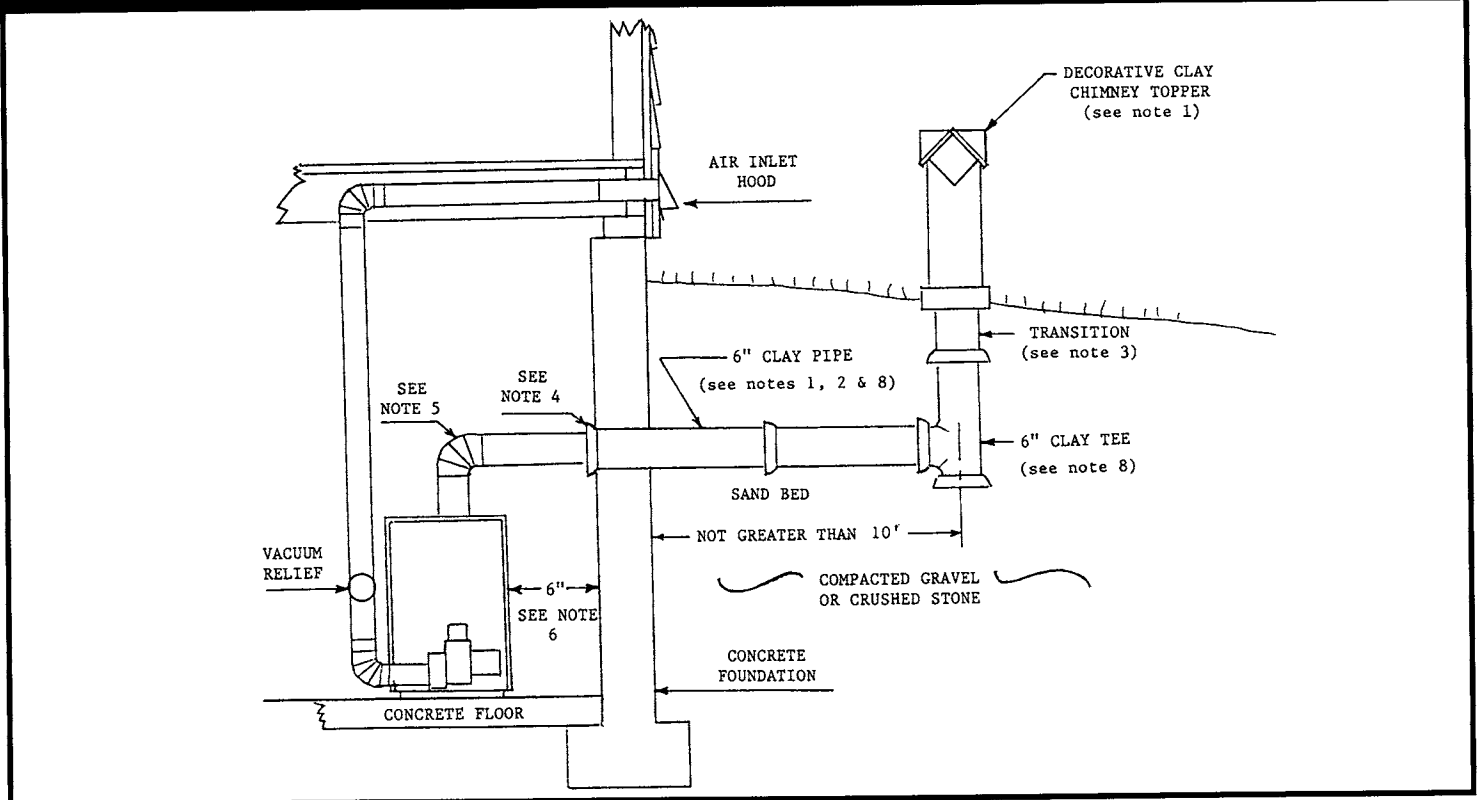
NOTES FOR FIGURE 11 – VENT HOOD LOCATION

Location of the termination of the vent pipe shall be in accordance with the National Fuel Gas Code; A.N.S.I., Z223.1 (see requirements below) and any local codes which are applicable. Only one boiler may be exhausted through each vent hood.

- The exit terminals of mechanical draft systems shall not be less than 7 feet above grade when located adjacent to public walkways.
- A venting system shall terminate at least 3 feet above any forced air inlet located within 10 feet.
- The venting system shall terminate at least 4 feet below, 4 feet horizontally from or 1 foot above any door, window or gravity air inlet into any building.

- An appliance with an input of over 50,000 BTU per hour shall require a 12 inch vent termination clearance from any opening. The bottom of the vent terminal and any air intake shall be located at least 12 inches above grade level.
- Forced draft systems shall be designed and installed so as to prevent leakage of vent gasses into building.
- The vent termination point shall not be installed closer than 3 feet from an inside corner of an L-shaped structure.
- Terminate the vent above normal snow line. Avoid locations where snow may drift and block the vent. Ice or snow may cause the boiler to shut down if the vent becomes obstructed.

FIG. 11A – TYPICAL UNDERGROUND VENT INSTALLATION



ALTERNATE UNDERGROUND VENT

When the structure of the house or the exterior grade does not allow location of the vent terminal in compliance with instructions on pages 11 and 12, an alternative is to vent into a clay pipe system installed underground. Refer to notes below and Figure 11A.

NOTES FOR UNDERGROUND VENT INSTALLATION

- Clay chimney topper, tee and pipe are manufactured by Superior Clay Corp., P.O. Box 352, Uhrichsville, Ohio 44683. Clay chimney top devices and pipe from other sources may be used.
- Clay pipe must pitch downward away from foundation $\frac{1}{8}$ " to $\frac{1}{4}$ " per foot.

- Configuration of transition from tee to topper is dependent on the type of the topper selected and the level of the finished grade. Topper must be removable for cleaning.
- Seal opening in foundation around clay pipe with hydraulic cement.
- Seal all joints and seams in smoke pipe with silicone rubber.
- When tankless side of boiler must be next to wall, allow enough distance to remove coil (18").
- Do not use a draft regulator in flue pipe.
- 6" flue sizes shown on diagram are appropriate for input up to 1.50 gph or 210,000 Btu per hour. 8" flue components may be used for larger firing rates.

SYSTEM PIPING

1. Antifreeze added to boilers must be non-toxic, and must be of a type specifically intended for use in closed hydronic heating systems. Under no circumstances should automotive antifreeze be used.
2. Use of antifreeze in any boiler may reduce capacity by 10% or more and increase fuel consumption. Tankless coil performance will fall as concentration of antifreeze is increased. See below for water volumes of boilers and piping.
3. Because antifreeze forms slush rather than hard ice, it is safe to protect only to 10 degrees above coldest temperature anticipated provided slush formed can move towards expansion tank.

BOILER WATER VOLUMES

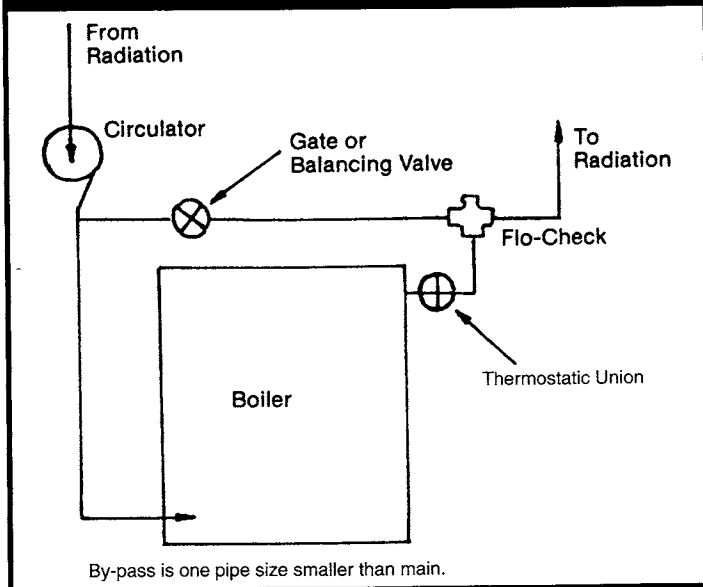
MODEL NUMBER	GALLONS	MODEL NUMBER	GALLONS
PF-3	7	PF-3T	10
PF-4	9	PF-4T	12
PF-5	11	PF-5T	14
PF-7	15	PF-6T	16
PF-9	19	PF-8T	20

PIPING WATER VOLUMES

Divide total length of piping in feet by appropriate factor below to determine volume in gallons.

PIPE SIZE	COPPER PIPE FACTOR	STEEL PIPE FACTOR
1/2"	82.5	63.5
3/4"	40.0	36.0
1"	23.3	22.2
1-1/4"	15.3	12.8
1-1/2"	10.8	9.5
2"	6.2	5.8

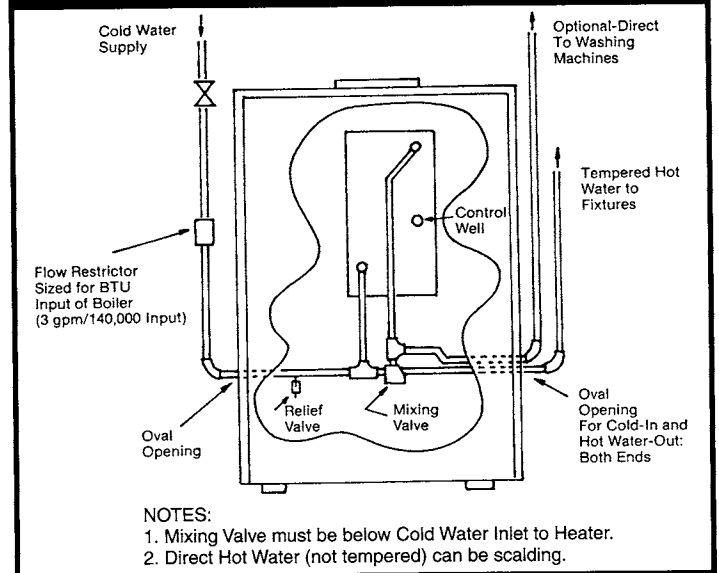
FIG. 12 – RECOMMENDED BY-PASS PIPING TO AVOID CONDENSATION



As efficiencies increase and stack temperatures decrease, it becomes increasingly important to keep boiler warm enough to discourage condensation. All steel and cast-iron boilers can rust badly if operated for extended periods at water temperatures below 140°, and chimneys can be damaged as well.

The purpose of the by-pass shown in Figure 12 is to permit the boiler to warm up faster than the radiation system, thereby decreasing the potential for condensation in both boiler and chimney.

FIG. 13 – TYPICAL TANKLESS COIL PIPING



L8151 CONTROL SETTINGS

Use the following setting for the first adjustment:

High Limit Set Point . . . 180°F

Low Limit Set Point . . . 160°F

Differential 20°F

These settings may be altered based on the heating system response. During very cold weather if the heating system does not provide quite enough heat, the high limit control setting may be raised to a maximum of 200°F. If more domestic hot water is required, the low limit control setting may also be raised to a maximum of 180°F. Whenever adjusting either the high or low limit the high limit control setting must be set at least 20°F above the low limit. The differential control setting is typically 20°F but may be adjusted to vary the time it takes the burner to respond to a call for domestic hot water.

COLD STANDBY

1. Cold standby is suitable only when thermostatic union (available from Dunkirk) is used with piping bypass shown in Figure 12.
2. A change in control wiring is also required. **To prevent excessive condensation** please contact Dunkirk factory before making this change.
3. Owners of non-tankless boilers often object to the burner starting when space heat is not required. To avoid this, an optional outside thermostat may be used to shut down the system totally when outside temperature is above a specific limit set by the homeowner. See wiring diagrams.

Oil Burner and Controls Start-Up and Adjustment

INDOOR CHIMNEY VENTED BOILERS

Instruction manual enclosed in burner carton must be followed in regard to start-up and adjustment

1. Standard Beckett AFG or CF375 Oil Burner

A Beckett model AFG oil burner is normally supplied with boilers to be fired at 2.00 gph or less. It is equipped with an F3 flame retention head, the size most commonly used. It is possible the head must be **changed to match the nozzle firing rate required**, and it is recommended the installer carry a complete assortment of Beckett flame retention heads. When head ratings overlap, a smaller head with air shutter fairly well open will generally provide better combustion than a larger head with air shutter near closed. See head size selection chart on page 16. For Beckett burners at firing rates above 2.00 gph, a Beckett model CF375 burner is required, and is supplied if specified by purchaser.

2. Optional Riello 40 Series Oil Burner

Riello 40 series oil burner is optional. Model F5 is used for firing rates from 0.90 to 1.50 gph, and Model F10 is used for firing rates from 1.60 to 3.00 gph. Model F5 or F10 is supplied if specified by purchaser. For firing rates below 0.90 gph, a Model F3 is required, and must be purchased from a Riello distributor.

SUGGESTED NOZZLES, HEADS, AND PRELIMINARY SETTINGS FOR VARIOUS FIRING RATES AND BURNERS ARE SHOWN ON PAGES 40 AND 41.

3. On knockdown boilers, **the burner is not supplied with a nozzle**. The correct nozzle is the smallest which will do the job properly. Long continuous runs with minimum starts and stops conserve the most energy. The nozzle which provides the highest C02 with the least smoke for a particular application is always recommended. Beckett Oil burners are supplied with pump pressure set at 140 psi. Nozzle output will be approximately 18% greater than that at 100 psi. Pump pressure on Riello burners should be adjusted according to settings on page 41.

4. **WARNING:** Too low a firing rate can cause excessive condensation within the boiler and chimney resulting in severe rust and corrosion. A piping by-pass is recommended to minimize this problem. See page 14.

HEAD	FIRING RATE, GPH	LOW FIRE BAFFLE
F0	.50	X
	.65	X
	.75	—
F3	.75	X
	.85	X
	.90	—
	1.00	—
F6	.85	X
	.90	X
	1.00	—

5. If Beckett AFG burner is to be fired at less than 1.00 gph, it is possible that a low firing rate baffle will be required. For firing rates not specified on page 40, see chart below on which an "x" indicates that a baffle is necessary. See also instruction sheet with baffle in burner carton.
6. Using three acorn nuts, studs and washers from hardware package, fasten burner to mounting plate.
7. Mount L8151 control on boiler jacket above and to the right of burner using sheet metal screws in holes located in jacket. Wiring harness is provided. When well is used at the rear of a larger boiler, it might be necessary to relocate the control with longer wiring not provided.
8. If the boiler is equipped with a tankless coil, insert well for the L8151 remote bulb in coil plate. Run capillary tube through sight glass opening in jacket.
9. If a tankless coil is not used, install 3/4" well and bulb with a bushing either in the 1 1/2" supply opening opposite the one used to feed radiation, or in a reducing tee in the 1 1/2" supply opening that actually feeds radiation.
10. Wiring diagram is found on page 16. To avoid excessive condensation, do not use a two-stage thermostat or other fuel saving devices or techniques without first contacting the factory.
11. **BEFORE MAKING CONTROL ADJUSTMENTS**, verify that all fuel, water and electrical connections have been made in accordance with the regulations of the National Fire Prevention Association, the National Electrical Code and/or local regulations.
12. See page 14 for control settings.
13. **Start-Up and Adjustment:** Start and adjust burner according to manufacturer's instructions contained in burner carton or included with packaged boiler, and pay special attention to the following:
 - a. As the name suggests, this boiler is designed to produce the ultimate in useable heat from a gallon of fuel oil. To adjust the air-fuel mixture by eye is to waste fuel and create soot.
 - b. **Repeat - Do not adjust air by eye.** Any time air adjustment or oil rate is changed, combustion **must** be checked with instruments.
 - c. With chamber fully warmed up, find the highest C02 level at which zero smoke can be maintained. Then add extra air until C02 falls off 1%. Final setting should be at least 11% C02. If unable to obtain that reading, check for internal oil leaks, incorrect flame retention head or a faulty or incorrect nozzle. (See charts on page 16.) Draft will vary as air is adjusted. It should be left at as near zero as possible at breeching.

Complete installation must be made in accordance with the requirements of local authorities and the National Fire Protection Association

BECKETT OIL BURNER RETENTION HEAD SELECTION CHART

Use Model AFG Burner up to 2.00 gph only	
Head	Max. Firing Rate
F0	0.75
F3	1.25
F6	1.65
F12	1.75
F22	2.00

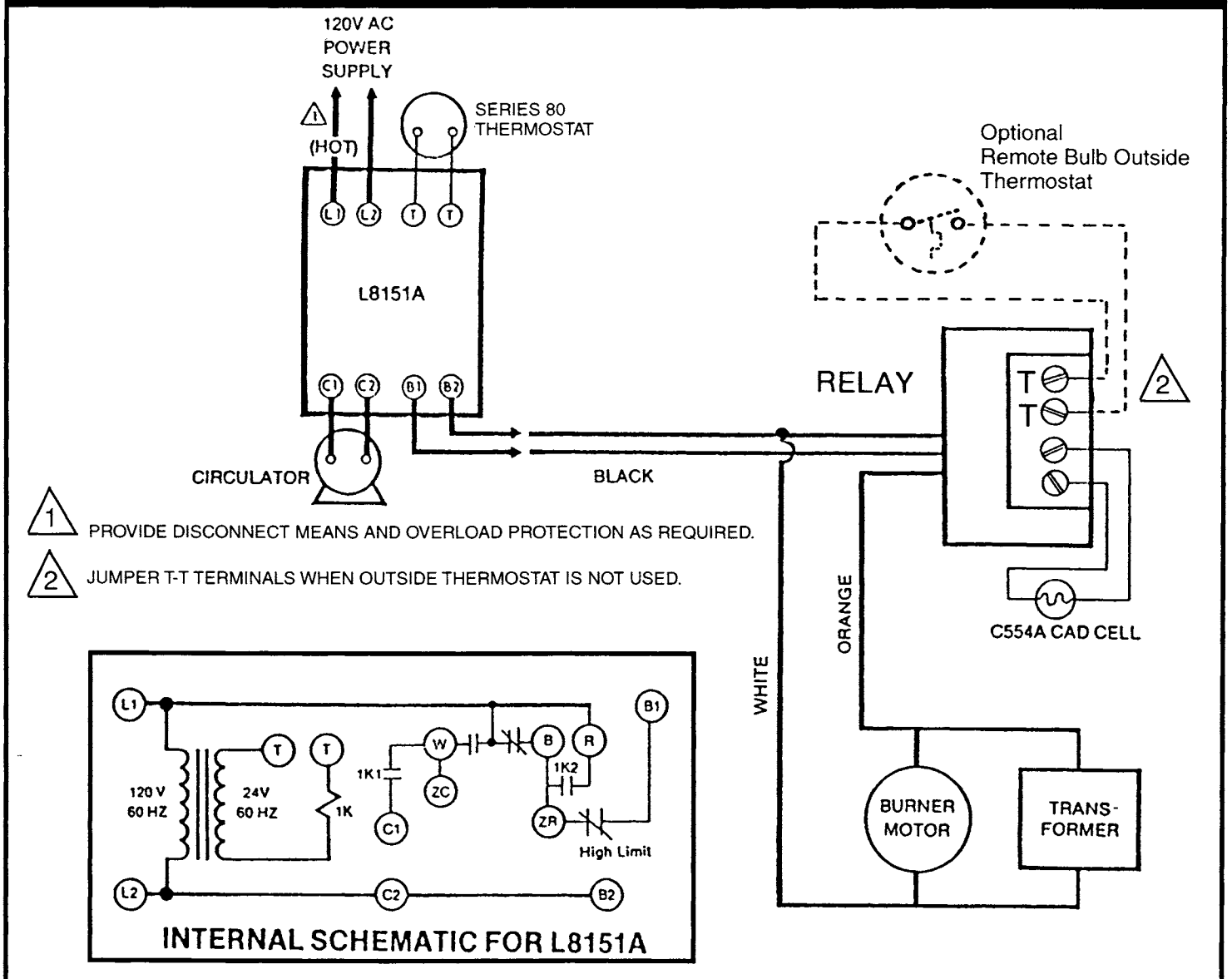
When a choice between two heads exists, recommended is the head which will perform at or near its maximum firing rate.

TYPICAL NOZZLE TYPES AND SIZES FOR BECKETT BURNERS

BOILER MODEL	NOZZLE
PF-3	80° Hollow or Solid
PF-3T and PF-4	80° Hollow or Solid
PF-4T, PF-5 and PF-5T	80° Hollow or Solid
PF-6T and PF-7	70° or 80° Hollow or Solid
PF-8T and PF-9	70° Solid

NOTE: The description of nozzle spray patterns varies between manufacturers. The correct nozzle is that which provides the highest CO₂ at the lowest smoke reading.

**FIG. 14 – BECKETT BURNER WIRING DIAGRAM
INDOOR CHIMNEY VENTED OIL BOILERS WITH OPTIONAL OUTSIDE THERMOSTAT**



With all high efficiency boilers, care must be taken to minimize condensation. Therefore, **cold standby is not recommended** and may be used only with a piping, bypass as shown on Figure 12. This requires a change in control wiring. Please contact factory prior to making that change.

When cold standby is **not** utilized, the homeowner might possibly object to the burner starting when space heat is not required. To avoid this, an optional outside thermostat may be used to shut down the system totally when outside temperature is above a specific limit set by the homeowner. When outside thermostat is not used, Jumper T-T Terminals on relay.

L8151 CONTROL SETTINGS

Use the following setting for the first adjustment:

High Limit Set Point 180°F
Low Limit Set Point 160°F
Differential 20°F

These settings may be altered based on the heating system response. During very cold weather if the heating system does not provide quite enough heat, the high limit control setting may be raised to a maximum of 200°F. If more domestic hot water is required, the low limit control setting may also be raised to a maximum of 180°F. Whenever adjusting either the high or low limit the high limit control setting must be set at least 20°F above the low limit. The differential control setting is typically 20°F but may be adjusted to vary the time it takes the burner to respond to a call for domestic hot water.

Oil Burner and Controls Start-Up and Adjustment

INDOOR DIRECT EXHAUST BOILERS

Instruction manual enclosed in burner carton must be followed in regard to start-up and adjustment

1. A Beckett model AFG post-purge oil burner is normally supplied with boilers to be fired at 2.00 gph or less. It is equipped with an F3 flame retention head, the size most commonly used. **It is possible the head must be changed to match the nozzle firing rate required,** and it is recommended the installer carry a complete assortment of Beckett flame retention heads. When head ratings overlap, a smaller head with air shutter fairly well open will generally provide better combustion than a larger head with air shutter near closed.
SEE HEAD SIZE SELECTION CHART ON PAGE 16. SUGGESTED NOZZLES, HEADS, AND PRELIMINARY SETTINGS FOR VARIOUS FIRING RATES ARE SHOWN ON PAGE 40.
2. At firing rates above 2.00 gph, a **special** Beckett model CF375 burner **must** be used and is supplied if specified by purchaser.
3. Post-purge oil burners are supplied with pump pressure set at 140 psi. Nozzle output will be approximately 18% greater than that at 100 psi.
4. **The burner is not supplied with a nozzle.** The correct nozzle is the smallest which will do the job properly. Long continuous runs with minimum starts and stops conserve the most energy. The nozzle which provides the highest CO2 with the least smoke for a particular application is always recommended.
5. **WARNING:** Too low a firing rate can cause excessive condensation within the boiler and flue resulting in severe rust and corrosion. A piping by-pass is recommended to minimize this problem. See Figure 12.
6. If Beckett AFG burner is to be fired at less than 1.00 gph, it is possible that a low firing rate baffle will be required. For firing rates not specified on page 40, see chart below on which an "x" indicates that a baffle is necessary. See also instruction sheet with baffle in burner carton.

HEAD	FIRING RATE, GPH	LOW FIRE BAFFLE
F0	.50	X
	.65	X
	.75	—
F3	.75	X
	.85	X
	.90	—
	1.00	—
F6	.85	X
	.90	X
	1.00	—

7. Using three acorn nuts, studs and washers from hardware package, fasten burner to mounting plate. Do not disturb chamber when inserting firing head.
8. Mount L8151 control on boiler jacket above and to the right of burner using sheet metal screws in holes located in jacket. Wiring harness is provided. When well is used at the rear of a larger boiler, it might be necessary to relocate the control with longer wiring not provided.
9. If boiler has a tankless coil, insert well for the L8151 remote bulb in coil plate. Run capillary tube through sight glass opening in jacket.
10. If a tankless coil is not used, install 3/4" well and bulb with a bushing either in the 1 1/2" supply opening opposite the one used to feed radiation, or in a reducing tee in the 1 1/2" supply opening that feeds radiation.
11. Mount overfire pressure switch at upper right of burner on screws already in jacket. Connect by 1/4" copper tube to brass tee at upper left of burner.
Burner will shut down if overfire pressure reaches .17" H2O due to a plugged flue or high wind. If high wind causes nuisance shutdowns, mount switch on an angle bracket with diaphragm horizontal. Shutdown will then occur at .25" H2O.

12. Wiring diagram is found in Figure 15. To avoid excessive condensation, do not use a two-stage thermostat or other fuel saving devices or techniques without first contacting the factory.
13. Install Gar-Ber filter as provided rather than a standard filter between burner and oil storage tank.
14. **BEFORE MAKING CONTROL ADJUSTMENTS**, verify that all fuel, water and electrical connections have been made in accordance with the regulations of the National Fire Prevention Association, the National Electrical Code and/or local regulations.
15. **Start-Up and Adjustment:** Start and adjust burner according to manufacturer's instructions contained in burner carton or included with packaged boiler, and pay special attention to the following:
 - a. As the name suggests, this boiler is designed to produce the ultimate in useable heat from a gallon of fuel oil. To adjust the air-fuel mixture by eye is to waste fuel and create soot.
 - b. **Repeat – Do not adjust air by eye.** Any time air adjustment or oil rate is changed, combustion **must** be checked with instruments.
 - c. With chamber fully warmed up, find the highest CO₂ level at which zero smoke can be maintained. Then add extra air until CO₂ falls off 1%. Final setting should be at least 11% CO₂. If unable to obtain that reading, check for internal oil leaks, incorrect flame retention head or a faulty or incorrect nozzle. (See nozzle chart on page 16.)
16. **Post Purge Timing:** With through the wall venting there is no over-fire draft present after the burner shuts down. Therefore, a post purge must be used to prevent the hot chamber from overheating the nozzle.

The post purge timer is part of the Honeywell intermittent primary control, which is located on the Beckett oil burner. The post purge time has been preset to 4 minutes but may be adjusted to 0, 2, 4, or 6 minutes by adjusting the switches on the side of the intermittent primary control.

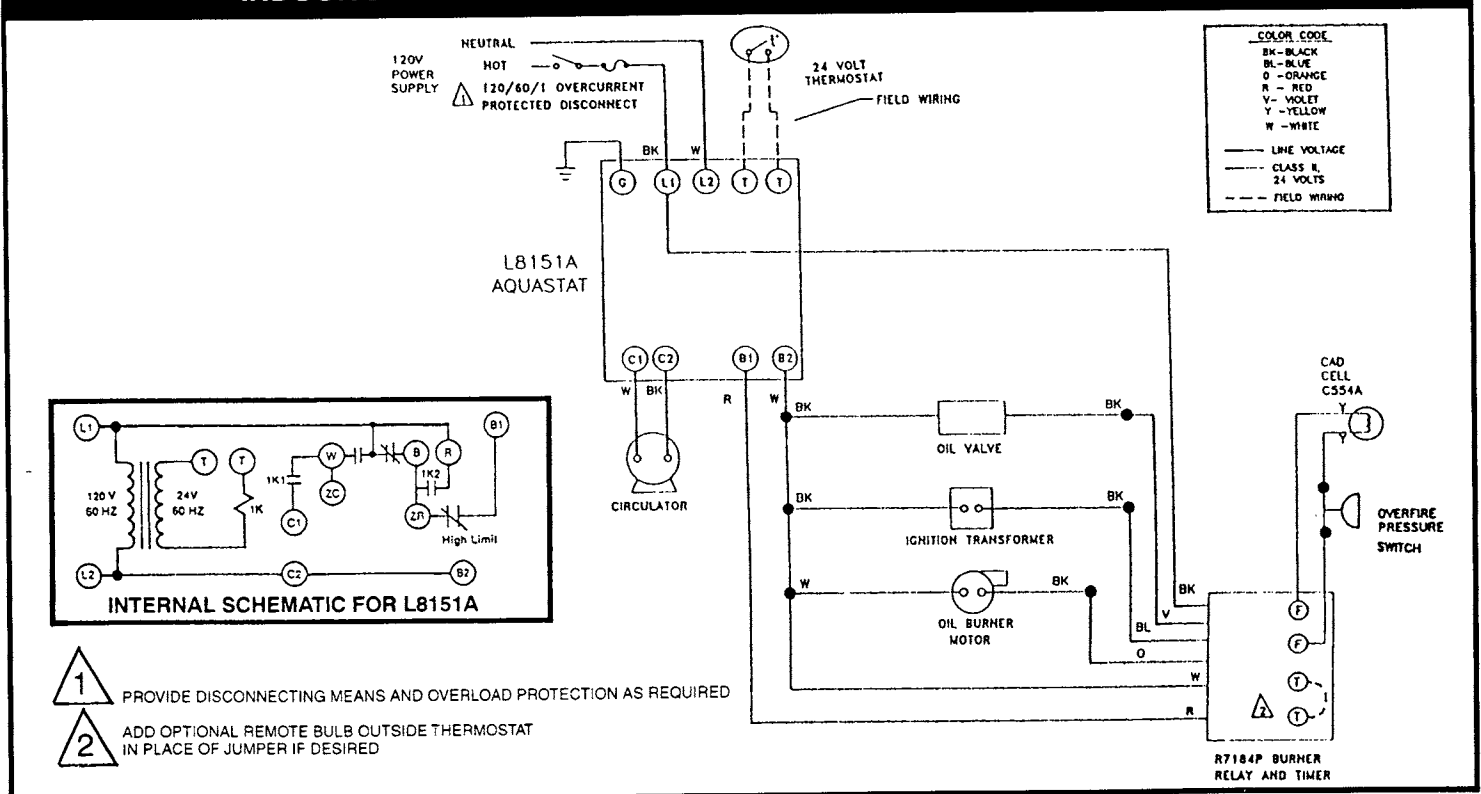
With a stack thermometer in place, the boiler fully warmed up (200°F or more), and the boiler running, turn the high limit control on the aquastat all the way down. The burner motor should then be running with the flame off (i.e. in post purge). Measure the time it takes from the flame off until the stack temperature falls to the same temperature as the boiler water. Adjust the post purge timer to nearest time interval, always rounding up if possible. For example, if the time measured is 3 minutes and 20 seconds then set the post purge timer at 4 minutes.

Whenever the nozzle is removed for service, check for varnish forming on the outside of the nozzle. If carbon and varnish do not wipe off easily, increase the post purge time.

17. **Limited Recycle and Limited Reset:** The Honeywell R7184P1031 interrupted-duty primary control utilizes two safety features to protect the boiler from being saturated with oil. Limited recycle will allow the burner 3 attempts to ignite, if ignition is unproven the control locks-out. The control's reset button can then be pressed. The limited reset feature will allow the burner to be reset 3 times before it locks-out. To unlock the control requires the reset button to be held for 30 seconds.

Complete installation must be made in accordance with the requirements of local authorities and the National Fire Protection Association.

**FIG. 15 – BECKETT BURNER WIRING DIAGRAM
INDOOR DIRECT EXHAUST OIL BOILERS WITH POST PURGE BURNER**



With all high efficiency boilers, care must be taken to minimize condensation. Therefore, **cold standby is not recommended** and may be used only with a piping bypass as shown in Figure 12. This requires a change in control wiring. Please contact factory prior to making that change.

When cold standby is not utilized, the homeowner might possibly object to the burner starting when space heat is not required. To avoid this, an optional outside thermostat may be used to shut down the system totally when outside temperature is above a specific limit set by the homeowner.

L8151 CONTROL SETTINGS

Use the following setting for the first adjustment:

High Limit Set Point180°F
Low Limit Set Point160°F
Differential 20°F

These settings may be altered based on the heating system response. During very cold weather if the heating system does not provide quite enough heat, the high limit control setting may be raised to a maximum of 200°F. If more domestic hot water is required, the low limit control setting may also be raised to a maximum of 180°F. Whenever adjusting either the high or low limit the high limit control setting must be set at least 20°F above the low limit. The differential control setting is typically 20°F but may be adjusted to vary the time it takes the burner to respond to a call for domestic hot water.

Gas Burner and Controls Start-Up and Adjustment

INDOOR CHIMNEY VENTED AND DIRECT EXHAUST BOILERS

Instruction manual enclosed in burner carton must be followed in regard to fuel type as well as start-up and adjustment instructions.

1. Burner Head/Electrode Assembly

An Adams gas burner shipped with a PF Series boiler purchased directly from the factory will be equipped with the proper flame retention head to match boiler input as specified by the purchaser. *However*, a boiler drawn from the stock of a wholesale distributor will normally be equipped with a size G-0 head which might be necessary to change to match boiler input rate. It is recommended that the installer carry a complete assortment of heads for this purpose.

See page 20 for burner head selection guide.

2. Burner Orifice

An Adams burner is supplied with two orifice plates, one attached to each end of the orifice spring inside the gas manifold. Unless specified otherwise prior to shipment from the factory, the "primary" orifice plate, mounted toward the burner head, will be sized to fire **Natural Gas** at the minimum input range of a G-0 head. The "spare" orifice plate, located at the opposite end of the orifice spring and stained red, will be that which delivers the minimum rate for **Propane Gas**.

The two orifice plates are interchangeable and the inside diameter of either can be enlarged with a tapered reamer to obtain a higher rate within the burner head firing range. See page 20 for orifice sizing.

It is not necessary to disassemble the burner to change or enlarge gas orifices. (See orifice change out diagram on page 21.) If necessary, remove the orifice cap and select the proper (natural or propane) gas orifice plate. Ream out the inside diameter, if necessary, using a proper size drill to check the opening size. Mount the orifice plate in the primary position on the orifice spring, insert the spring assembly into the manifold and tighten the orifice cap. Do not over-tighten.

3. Using three acorn nuts, studs and washers from hardware package, fasten burner to mounting plate.
4. Mount L8151 control on boiler jacket above and to the right of burner using sheet metal screws in holes provided in jacket. Wiring harness is provided. When well is used at the rear of a larger boiler, it might be necessary to relocate the control with longer wiring not provided.
5. If a tankless coil is included in the boiler, insert the well for the L8151 remote bulb in the coil plate. Run capillary tube through sight glass opening in jacket.
6. If the boiler does not include a tankless coil, install 3/4" well and bulb with a bushing either in the 1 1/2" supply opening opposite the one used to feed radiation, or in a reducing tee in the 1 1/2" supply opening that feeds radiation.
7. Wiring diagram is found on page 21. Optional wiring shows use of outside thermostat to provide for total summer shutdown. To avoid excessive condensation, do not use a two-stage thermostat or other fuel-saving devices or techniques without first contacting the factory.
8. BEFORE MAKING CONTROL ADJUSTMENTS, verify that all fuel, water and electrical connections have been made in accordance with regulations of the National Fire Prevention Association, the National Electric Code and/or local regulations.
9. See page 21 for control settings.
10. **Start-Up and Adjustment:** Start and adjust burner according to manufacturer's instructions contained in burner carton or included with packaged boiler and pay special attention to the following important points:
 - a. As the name suggests, this boiler is designed to produce the ultimate in useable heat from the fuel used. To adjust the air-fuel mixture by eye is to waste energy and create undesirable gases.
 - b. **Repeat – Do not adjust air by eye.** Any time air adjustment or gas rate is changed, combustion **must** be checked with instruments.

CAUTION: A carbon monoxide tester must be used, not a smoke tester.

- c. **Air Adjustment Is Not Factory Set:** When first firing burner, start with air shutter much nearer closed than final setting anticipated. (At 70 MBH. shutter must be fully closed because some air always bypasses shutter.) With chamber fully warmed up, find the highest CO₂ level at which CO of less than 30 ppm can be maintained. Final setting should be at least 9% CO₂. If unable to obtain that reading, check for air leaks, incorrect flame retention head or for eductor tube not centered. For chimney vented boilers, draft will vary as air is adjusted. It should be left at as near zero as possible at breeching.

- d. The correct input rate is the smallest which will do the job properly. Long continuous runs with minimum starts and stops conserve the most energy.

Caution: An input rate that is too low can cause corrosive condensation in boiler and flue.

- e. All orifice sizes are approximate. Actual burner input will vary with heating values of gas supplied locally.

- f. The input for natural gas can be determined by timing the gas meter. To vary the gas input, install the nearest size orifice, and adjust the pressure regulator up or down for the exact input desired. Measure the manifold pressure at the pressure tap on gas valve.

NOTE: Do not exceed pressure adjustment range recommended by the gas valve manufacturer . . . not less than 3" and not greater than 4" of H₂O.

11. IF PUBLIC UTILITY REGULATIONS IN YOUR COMMUNITY REQUIRE LABELING OF THE BOILER WITH BURNER HEAD SIZE AND FIRING RATE, PLEASE USE LABEL FOR THAT PURPOSE ENCLOSED IN BOILER LITERATURE ENVELOPE.

Complete installation must be made in accordance with the requirements of local authorities and the National Fire Protection Association.

CAUTION

DO NOT USE SMOKE TESTER WITH GAS BURNER. USE CARBON MONOXIDE TESTER.

ADAMS G2T GAS BURNER SPECIFICATIONS

BURNER HEAD SELECTION	
Desired Firing Rate – BTU-HR	Head Size
70,000 to 110,000	G-0
110,000 to 180,000	GT4
180,000 to 210,000	GT6
210,000 to 240,000	GT8

ORIFICE SIZING G-0 HEAD ONLY				
Firing Rate BTU/HR	MANIFOLD PRESSURE 3.5" W.C. FOR BOTH GASES			
	NATURAL GAS		PROPANE GAS	
	Approx. Drill Size	Hole Size Dia. (In.)	Approx. Drill Size	Hole Size Dia. (In.)
70,000	3/16	.187	5/32	.156
80,000	#8	.199	#19	.166
90,000	#3	.213	#16	.177
100,000	#2	.221	3/16	.187
110,000	15/64	.235	#9	.196

ORIFICE SIZING GT4, GT6, GT8 HEADS				
Firing Rate BTU/HR	MANIFOLD PRESSURE 3.5" W.C. FOR BOTH GASES			
	NATURAL GAS		PROPANE GAS	
	Approx. Drill Size	Hole Size Dia. (In.)	Approx. Drill Size	Hole Size Dia. (In.)
110,000	D	.246	#9	.196
120,000	F	.257	#3	.213
130,000	I	.272	#2	.221
140,000	K	.281	15/64	.235
150,000	M	.295	C	.242
160,000	N	.300	1/4	.250
170,000	5/16	.312	G	.260
180,000	P	.323	I	.272
190,000	Q	.332	J	.277
200,000	S	.350	K	.281
210,000	23/64	.360	M	.295
220,000	3/8	.375	N	.300
230,000	25/64	.391	5/16	.312
240,000	Z	.413	O	.316

Orifice rates calculated at 1,000 BTU's per cubic foot of Natural Gas and 2,500 BTU's per cubic foot of propane.

FIG. 16 – ADAMS GAS BURNER HEAD SPECIFICATIONS

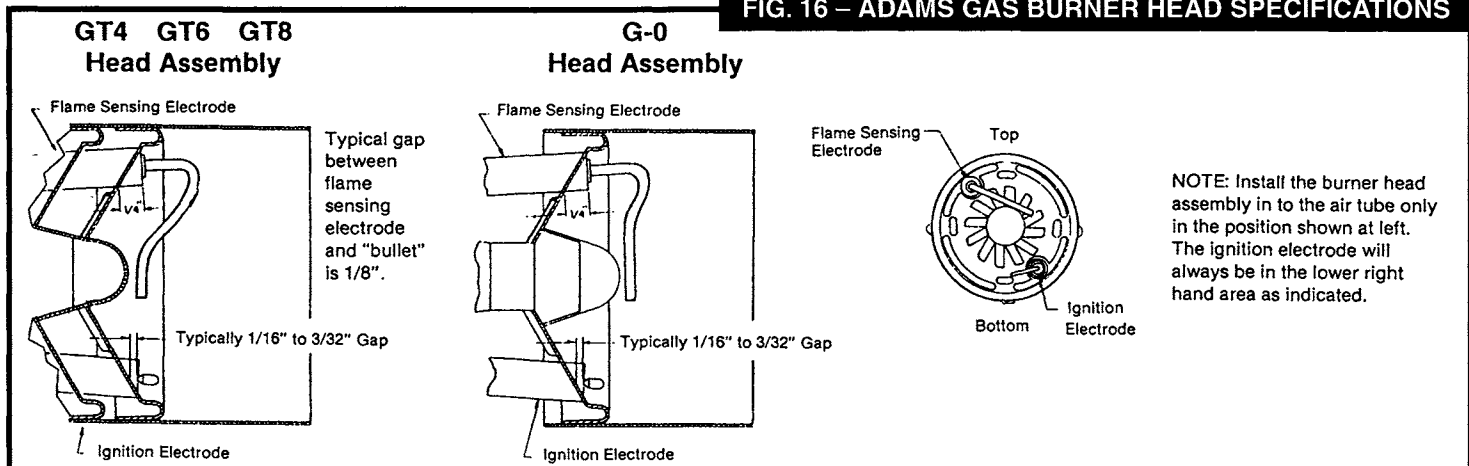


FIG. 17 – ORIFICE CHANGE OUT PROCEDURE

It is not necessary to disassemble the burner to change gas orifices. See detailed view at right. Simply remove the orifice cap and install the proper primary orifice on the spring. Insert the spring assembly into the manifold and tighten the orifice cap. Do not over-tighten.

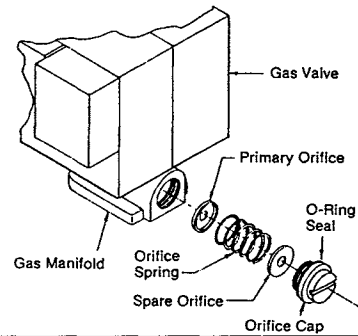
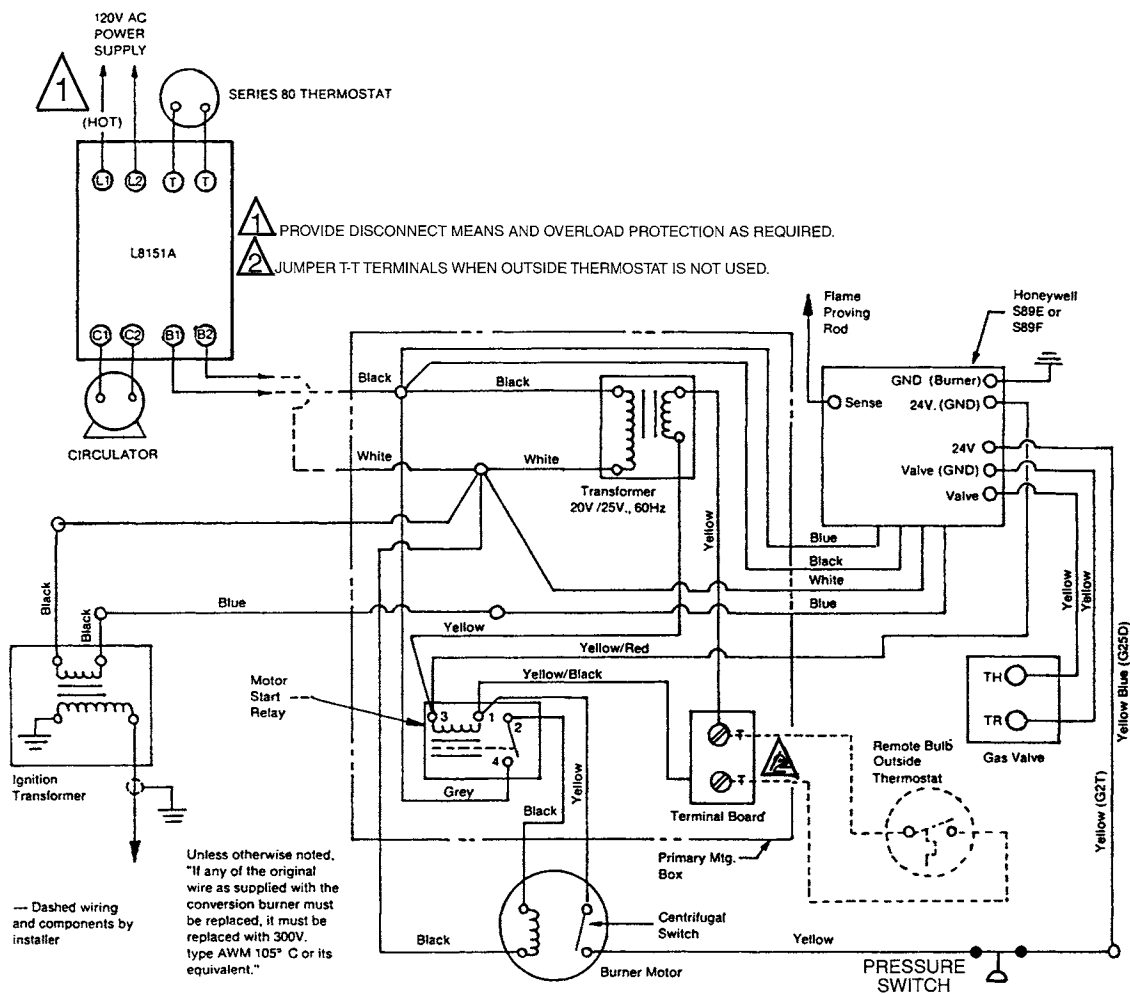


FIG. 18 – WIRING DIAGRAM

INDOOR CHIMNEY VENTED AND DIRECT EXHAUST GAS BOILERS WITH OPTIONAL OUTSIDE THERMOSTAT



With all high efficiency boilers, care must be taken to minimize condensation. Therefore, **cold standby is not recommended** and may be used only with a piping bypass as shown in Figure 12. This requires a change in control wiring. Please contact factory prior to making that change.

When cold standby is **not** utilized, the homeowner might possibly object to the burner starting when space heat is not required. To avoid this, an optional outside thermostat may be used to shut down the system totally when outside

temperature is above a specific limit set by the homeowner. When outside thermostat is not used, Jumper T-T Terminals.

L8151 CONTROL SETTINGS

Hi – not less than 200°. 20° or more above Lo setting.

Lo – not less than 180° for best tankless coil output. Lower settings may be used when tankless coil is not a factor.

Diff – 20° typical. May be changed to match system.

Weatherproof (Outdoor) Boiler Installation Instructions

LOCATING THE BOILER

1. Place boiler at a location as centralized as possible with the piping system and as free from unusual wind currents as possible.
2. A level concrete or non-combustible base is recommended with the top high enough so that ground water and melted snow will not rise as high as the bottom of the boiler. It is also recommended that crushed stone or gravel surround the base to keep shrubbery, weeds and grass at least 18" from the boiler.
3. If necessary, level boiler with shims placed beneath feet.
4. Accessibility clearances must take precedence over fire protection clearances. Allow at least 24" for servicing at the front and burner sides of the boiler. Allow at least 18" at a side where passage is required to another side for servicing. A 6" clearance from combustible material on all sides and the top is recommended.
5. Advise owner to maintain air passages free from obstructions. Ventilating and combustion air must enter boiler casing without restrictions.

ASSEMBLY AND PIPING – SPACE HEATING ONLY

(For Pool Heating, see page 23.)

1. Install 1½" nipples (not supplied) or smaller nipples with bushings in the two tappings in end of boiler opposite burner. These will provide feed to the radiation and return to the boiler. Supply pipe should be level or rise slightly toward air vent inside building. See Figure 23 for alternative air elimination method.
2. Circulator, make-up water, expansion tank, etc., should be installed at a convenient location **inside the building**.
 - a. **Domestic Water Heating.** See Figure 20 for piping of remote (indoor) tankless coil or indirect water heater. An Indirect Water Heater is recommended.
 - b. **Without Domestic Water Heating.** See Figure 21.
3. Place control well in top ¾" tapping near burner end of boiler.
4. Install a ¾" street ell in remaining top tapping. Mount relief valve on street ell using a ¾" x 7" nipple. Mount ¾" overflow pipe (not supplied) so that it extends downward beside boiler casting and will be covered by boiler jacket when jacket is in place. Do not extend overflow pipe so near the ground that it might become clogged with snow or ice.
5. At burner end of boiler mount theraltimeter with 1½" x 1/4" bushing in upper right 1½" tapping.
6. Install boiler drain with bushing in lower left 1½" tapping.
7. Referring to Figure 19, place Panel (1) over supply and return pipe nipples.

8. Attach Panels (2) and (3) to Panel (1) using sheet metal screws supplied.
9. Attach Panel (4) to Panels (2) and (3).
10. Fasten L8151 Control to upper right-hand side of Panel (4) with bulb in the control well already in place.
11. Install additional controls according to manufacturer's instructions included and to Wiring Diagram Figure 24 (oil installation) or Wiring Diagram Figure 26 (gas installation).
12. Install burner according to manufacturer's instructions with particular attention given to the following **IMPORTANT** information:
 - a. **Oil Installations.** See page 27 for firing rate head sizing and for nozzle sizing instructions. The F-3 head supplied might not be the correct size to match the firing rate required for this particular installation.
 - b. **Gas Installations.** See page 20 for head and orifice sizing. The head supplied might not be the correct size to match the boiler input rate required for this particular installation.
 - c. Fasten burner to burner mounting plate using three studs, washers and acorn nuts from hardware package. Be very careful to avoid disturbing combustion chamber when inserting air tube. Retention head must be set flush with inside wall of combustion chamber.
13. Connect piping to distribution system referring to Figure 20 for domestic water heating application, or to Figure 21 for systems without domestic water heating.
14. Verify that fuel, water and electrical connections have been made in conformance with all applicable codes.
15. Fill and test boiler and systems. Weatherproof space heating boilers require antifreeze. See page 26 for antifreeze information.
16. Cover all outdoor piping with weather-resistant insulation.
17. Start burner according to manufacturer's instructions and make combustion tests. It is suggested that the short length of smoke pipe be installed temporarily for ease in making tests. See Start-Up and Adjustment instructions on page 26 (oil installations) or page 28 (gas installations).
18. Referring again to Figure 19, fasten Front Jacket Panel (9) in position with sheet metal screws.
19. Install Jacket Top, part (5).
20. Install Exhaust Assembly with parts (6), (7) and (8). The exhaust cap is made to spring inside the short length of smoke pipe. A tourniquet made of wire or a large hose clamp may be used to reduce the diameter so that it will fit inside the pipe. Two or three hose clamps in series may be used when a large one is not available.

ASSEMBLY AND PIPING – POOL HEATING ONLY

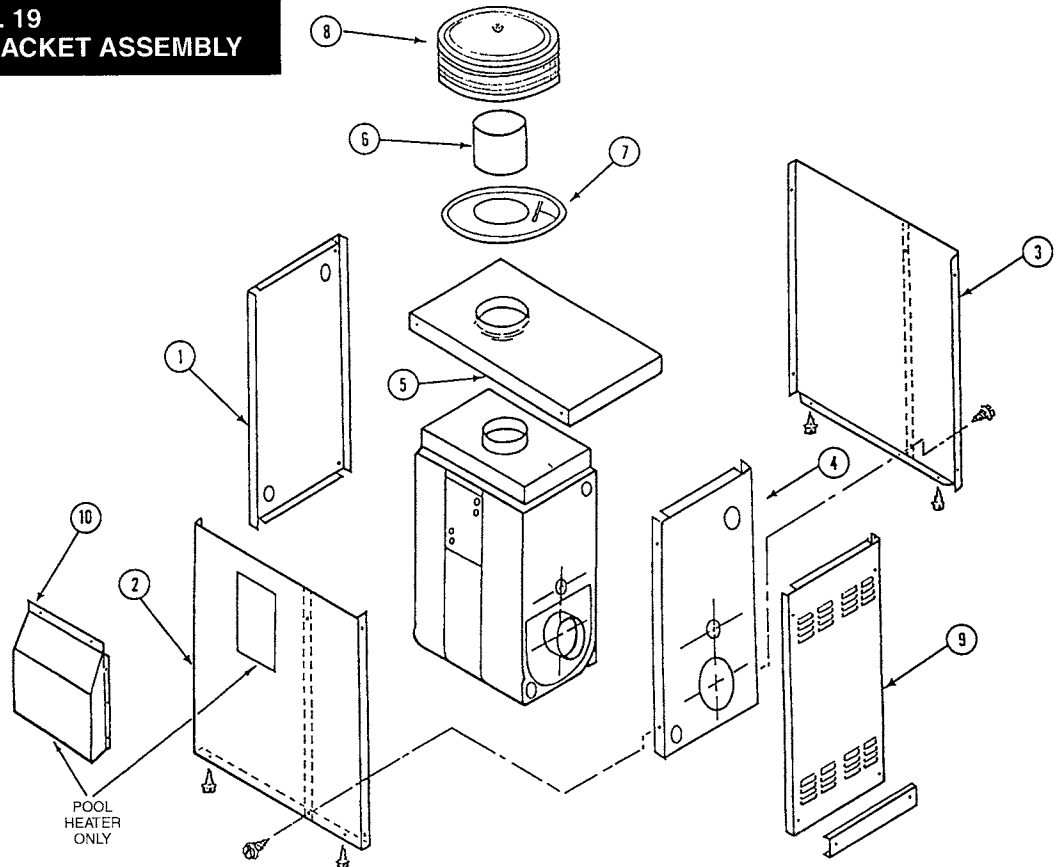
(For Space Heating, see page 22.)

1. Install 1½" black iron plugs in two tapings in end of boiler opposite the burner.
2. Place one aquastat well in top ¾" tapping near burner end of boiler.
3. Install a ¾" street ell in remaining top tapping. Mount relief valve on street ell using a ¾" x 7" nipple. Mount ¾" overflow pipe (not supplied) so that it extends downward beside the casting and will be covered by the boiler jacket when jacket is in place. See Figure 23 for alternative air venting.
4. At burner end of boiler, mount theraltimeter with ¼" x 1½" bushing in upper right-hand 1½" tapping.
5. In lower 1½" tapping, install tees for piping to expansion tank, for boiler drain and for make-up water supply. (Boiler drain, make-up water supply and/or expansion tank may be piped from opposite ends of the boiler from each other if more convenient.)
6. Referring to Figure 19, place Jacket Panel (1) against end of boiler opposite burner.
7. Attach Panels (2) and (3) to Panel (1) using sheet metal screws to be found in jacket carton.
8. Attach Panel (4) to Panels (2) and (3). (Pool heating aquastat may be mounted on Panel (4) if necessary.)
9. Pipe pool water circuit according to Figure 22.
10. Install burner according to manufacturer's instructions with particular attention given to the following **IMPORTANT** information:
 - a. **Oil Installations.** See page 27 for firing rate and head sizing instructions. The F-3 head supplied might not be the correct size to match the firing rate required for this particular installation.
 - b. **Gas Installations.** See page 20 for head and orifice sizing. The head supplied might not be the correct size to match the boiler input rate for this particular installation.
 - c. Using three acorn nuts from hardware package, fasten burner to burner mounting plate being very careful to avoid disturbing combustion chamber when inserting air tube. Retention head must be set flush with inside wall of combustion chamber.
11. Install controls according to manufacturer's instructions and to Wiring Diagram Figure 25 (oil installation) or to Wiring Diagram Figure 27 (gas installation).
 - a. Place boiler temperature limit control bulb in well already in place at top of boiler.
 - b. Place pool temperature operating control bulb in second well mounted at any point in piping from the pool before piping reaches the heating coil.
12. Verify that fuel, water and electrical connections have been made in accordance with all applicable codes.
13. Using a hose, fill boiler with tap water.
14. Test boiler and system..
15. Start burner according to manufacturer's instructions and make combustion tests. It is suggested that the short length of smoke pipe be installed temporarily for ease in making tests. See Start-Up and Adjustment instructions on page 26 (oil installation) or page 28 (gas installation).
16. Referring again to Figure 19, fasten Front Jacket Panel (9) in position with sheet metal screws.
17. Using self-tapping screws, fasten Coil Housing (10) to Side Panel (2) so that upper flange of housing is flush with top of panel.
18. Install Jacket Top, part (5), so that it covers upper flange of Coil Housing to ensure a weatherproof assembly..
19. Install Exhaust Assembly with parts 6, 7 and 8. The exhaust cap is made to spring inside the short length of smoke pipe. A tourniquet made of wire or a large hose clamp may be used to reduce the diameter so that it will fit inside the pipe. Two or three hose clamps in series may be used when a large one is not available.

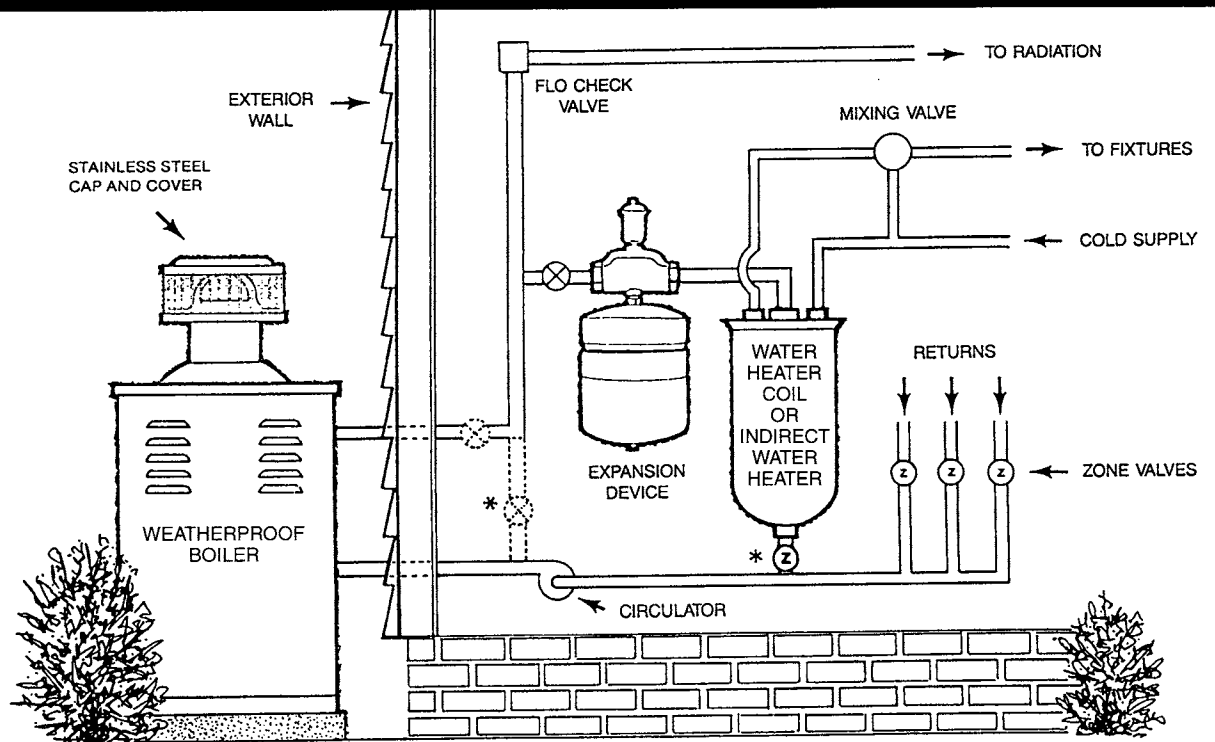
WINTERIZING

1. All water must be drained from boiler and piping to prevent freezing during cold weather.
2. Before draining, in order to maximize flow, isolate heat exchanger coil with valves from the rest of the system.
3. To drain water from low points in coil, blow air from a compressor (or vacuum cleaner) into one drain near the coil with a second drain wide open for maximum flow through the coil.

**FIG. 19
WEATHERPROOF JACKET ASSEMBLY**



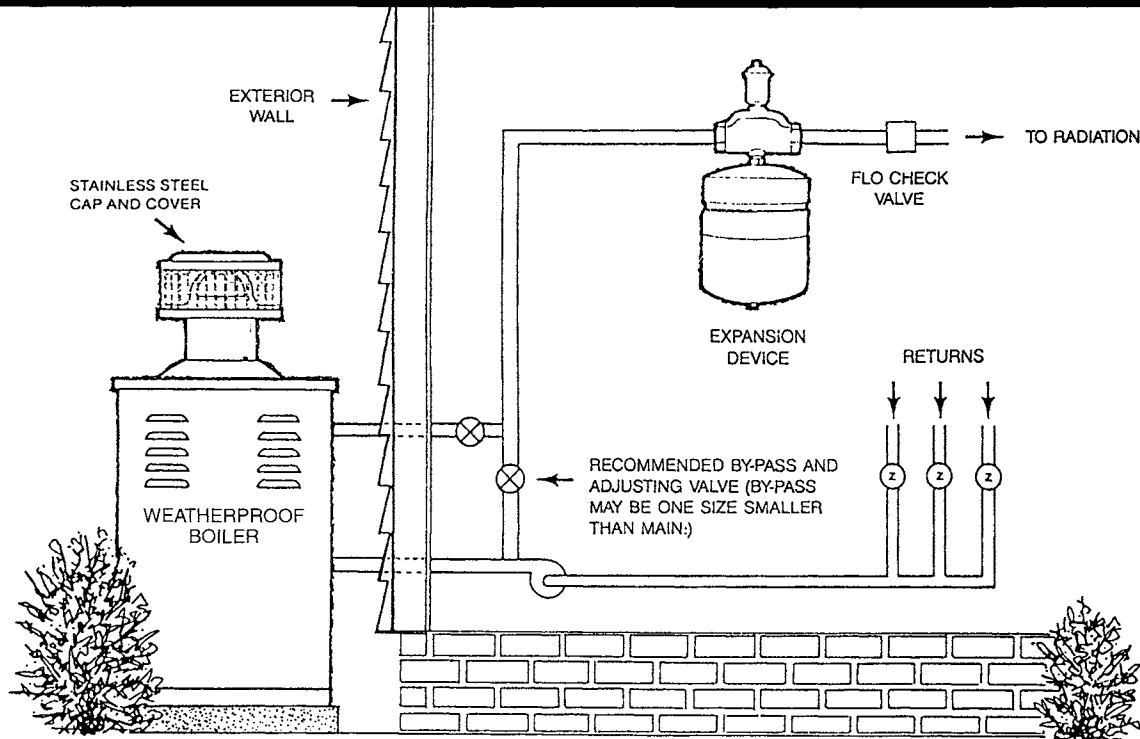
**FIG. 20
PIPING – WEATHERPROOF BOILER WITH INDOOR WATER HEATING UNIT**



To minimize heat loss, insulation of Water Heater Coil and exposed piping is recommended.

* Additional zone valve and by-pass as shown required only when Indirect Water Heater employed in which case see instructions enclosed with heater. Constant circulation is recommended when remote tankless coil employed.

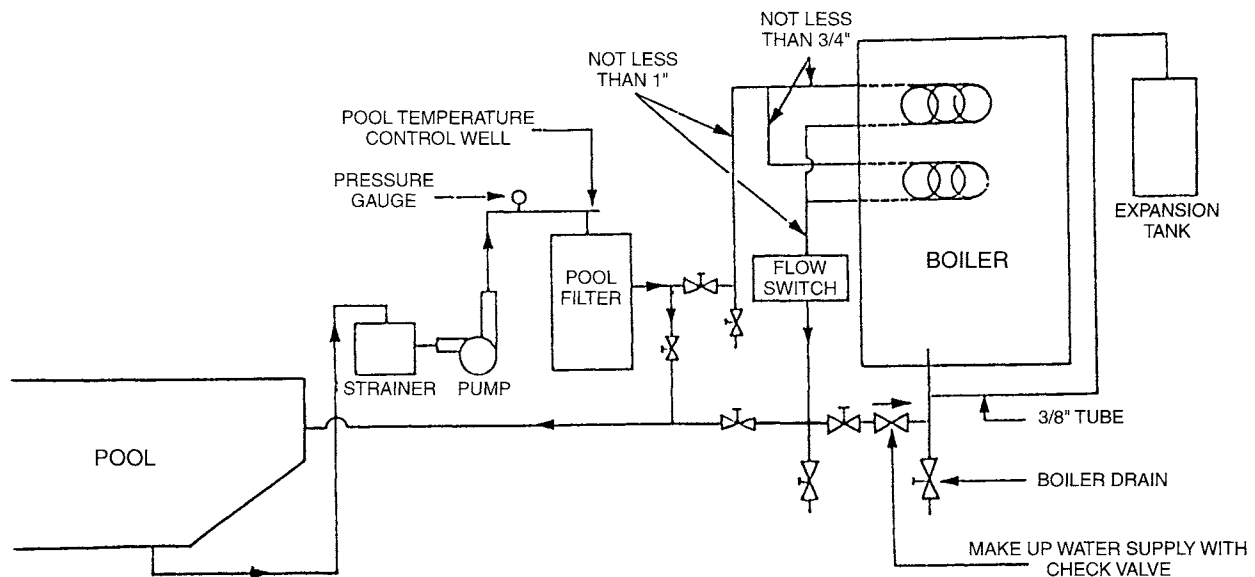
FIG. 21
PIPING – WEATHERPROOF BOILER WITHOUT INDOOR WATER HEATING UNIT



To minimize heat loss, insulation of exposed piping is recommended.

As efficiencies increase and stack temperature decreases, it becomes increasingly important to keep boiler warm enough to discourage condensation. All steel and cast-iron boilers can rust badly if run for extended periods at water temperature below 140°.

FIG. 22
SWIMMING POOL HEATER PIPING WITH ONE DOUBLE PASS HEAT EXCHANGER



TO DETERMINE WATER VOLUME OF POOL:
Multiply length x width x average depth x 7.5.

Example:
20' x 38' x 5' x 7.5 = 28,500 gals.

TO DETERMINE BTU REQUIREMENTS
according to pool capacity, see Ultimate Form I-307.

TO ADJUST FLOW RATE:
Begin with bypass fully open. Close bypass until pump pressure shows 3 to 4 p.s.i. increase. If boiler goes off on limit, close valve until burner runs steadily just short of limit temperature.

WHEN TWO SEPARATE DOUBLE-PASS HEAT EXCHANGERS ARE USED:
Pipe in parallel with not less than 1-1/4" mains.

NOTE: Before start-up, fill boiler with tap water. Pool water used for make-up only.

ANTIFREEZE

1. Antifreeze added to boilers must be non-toxic, and must be of a type specifically intended for use in closed hydronic heating systems. Under no circumstances should automotive antifreeze be used.
2. Use of antifreeze in any boiler may reduce capacity by 10% or more and increase fuel consumption. Tankless coil performance will fall as concentration of antifreeze is increased.
3. Because antifreeze forms slush rather than hard ice, it is safe to protect only to 10 degrees above coldest temperature anticipated provided slush formed can move towards expansion tank.

WATER VOLUMES OF PF SERIES BOILERS			
MODEL NO.	VOLUME IN GALLONS	MODEL NO.	VOLUME IN GALLONS
DPF3	7	DPF3T	10
DPF4	9	DPF4T	12
DPF5	11	DPF5T	14
DPF7	15	DPF6T	16
DPF9	19	DPF8T	20
		DPF7TT	21

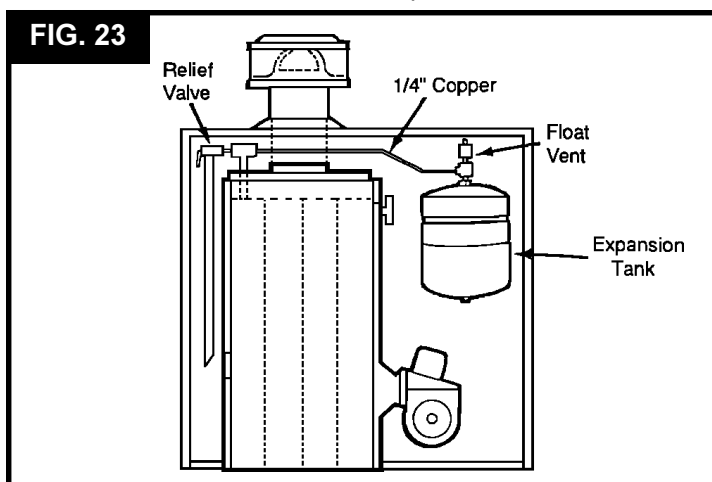
PIPING VOLUMES

Divide total length of piping in feet by Factor A below to determine water volume in gallons.

PIPE SIZE	PIPE MATERIAL	FACTOR
1/2"	Copper	82.5
1/2"	Steel	63.5
3/4"	Copper	40.0
3/4"	Steel	36.0
1"	Copper	23.3
1"	Steel	22.2
1 1/4"	Copper	15.3
1 1/4"	Steel	12.8
1 1/2"	Copper	10.8
1 1/2"	Steel	9.5
2"	Copper	6.2
2"	Steel	5.8

ALTERNATE AIR ELIMINATION METHOD

As boiler temperature increases, air will move from top of boiler toward float vent even if lower. As boiler temperature decreases, water will move from expansion tank toward boiler.



Oil Burner and Controls Start-Up and Adjustment

WEATHERPROOF BOILERS

This boiler was designed to produce the ultimate in useable heat from a gallon of fuel oil. To adjust the air-fuel mixture by eye is to waste fuel unnecessarily and to create undesirable soot.

Repeat - Do not adjust air by eye. Any time air adjustment or oil rate is changed, combustion **must** be checked with instruments. With chamber fully warmed up, find highest CO2 level at which zero smoke can be maintained. Then add extra air until CO2 falls off about 1%. Final setting should be at least 11% CO2. If unable to obtain that reading, check for internal oil leaks, incorrect flame retention head or faulty or incorrect nozzle. Draft will vary as air is adjusted. It should be left at as near zero as possible at breeching.

The correct nozzle is the smallest which will do the job properly. Long continuous runs with minimum starts and stops conserve the most energy. The nozzle which provides the highest CO2 with the least smoke for a particular application is always recommended.

Warning: A firing rate that is too low can result in a condensation problem within the chimney and boiler causing severe rust and corrosion. When domestic water is being heated, by-pass piping is recommended only when an Indirect Water Heater is used as shown on Figure 20. If **no** domestic water heating is involved, by-pass piping is **always** recommended as shown on Figure 21.

Beckett AFG or CF375 Oil Burner

A Beckett model AFG oil burner is used to fire boilers at 2.00 gph or less. At firing rates above 2.00 gph, a Beckett model CF375 is required. A model AFG burner shipped with your EV Series boiler is equipped with an F3 flame retention head, the size most commonly used. **It is possible the head must be changed to match the nozzle firing rate required**, and it is recommended the installer carry a complete assortment of Beckett flame retention heads. When head ratings overlap, a smaller head with air shutter fairly well open will generally provide better combustion than a larger head with air shutter near closed. See head size selection chart below. For firing rates under 1.00 gph

BECKETT RETENTION HEAD SELECTION CHART

Use Model AFG Burner up to 2.00 gph only	
Head Size	Max. Firing Rate
F0	0.75
F3	1.25
F6	1.65
F12	1.75
F22	2.00

TYPICAL NOZZLE TYPES AND SIZES FOR BECKETT BURNERS

BOILER MODEL	NOZZLE
PFO-3T2W and PFO-4W	80° Hollow or Solid
PFO-6T2W, PFO-7AW & PFO-7SW	70° or 80° Hollow or Solid
All Larger Models	60° or 70° Hollow or Solid

It should be recognized that the description of spray patterns might vary between nozzle manufacturers. In any case the nozzle recommended is that which provides the highest CO₂ with the least smoke for a particular application.

SUGGESTED NOZZLES, HEADS, AND PRELIMINARY AIR SETTINGS FOR VARIOUS FIRING RATES AND BURNERS ARE SHOWN ON PAGE 40.

L8151 CONTROL SETTINGS

Use the following setting for the first adjustment:

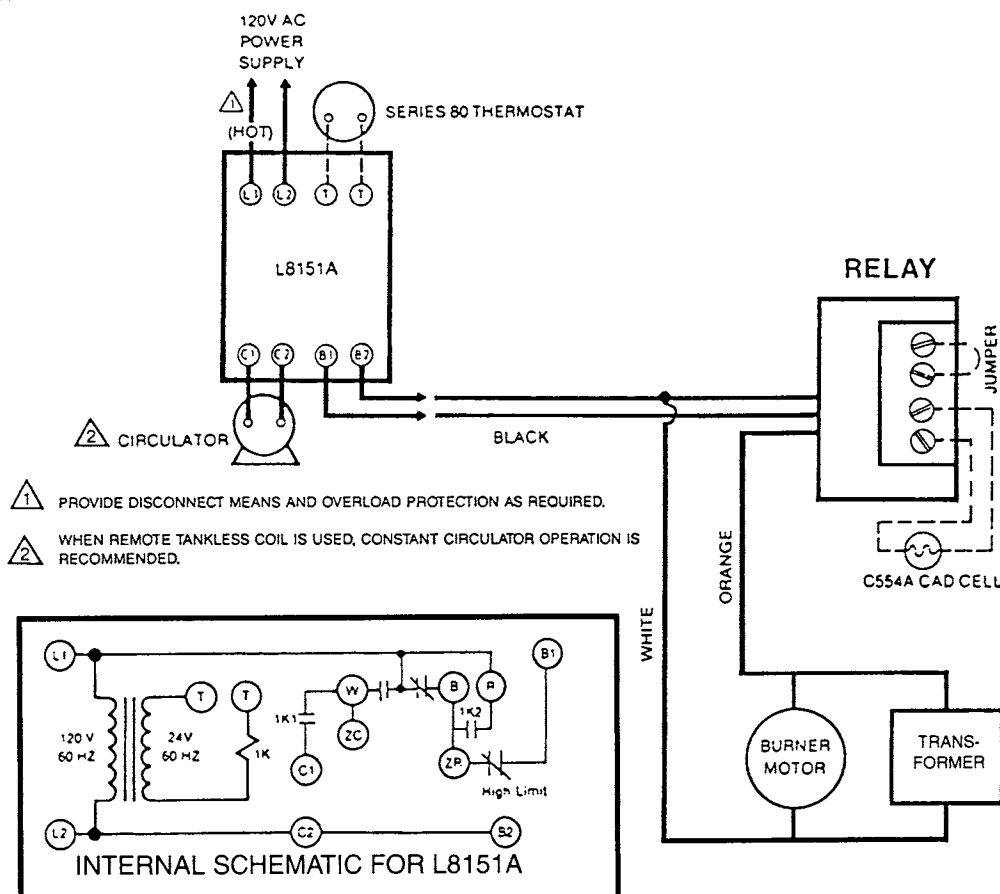
Hi Setting 180°F

Lo Setting 160°F

Differential 20°F

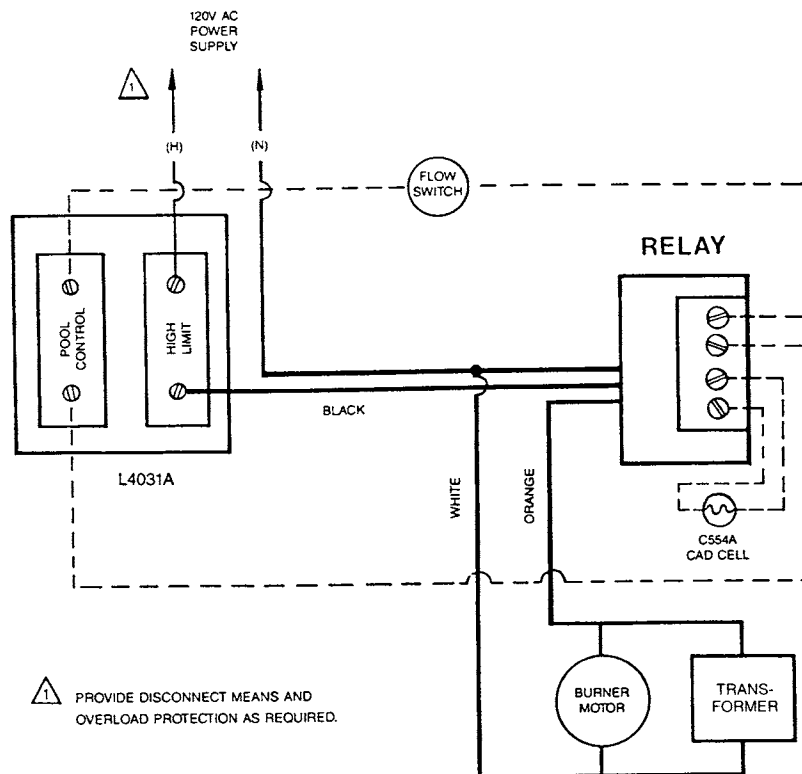
These settings may be altered based on the heating system response. During very cold weather if the heating system does not provide quite enough heat, the high limit control setting may be raised to a maximum of 200°F. If more domestic hot water is required, the low limit control setting may also be raised to a maximum of 180°F. Whenever adjusting either the high or low limit the high limit control setting must be set at least 20°F above the low limit. The differential control setting is typically 20°F but may be adjusted to vary the time it takes the burner to respond to a call for domestic hot water.

**FIG. 24 – BECKETT BURNER WIRING DIAGRAM
FOR WEATHERPROOF OIL-FIRED BOILER – SPACE HEATING**



NOTE: When Indirect Water Heater used, see manufacturer's wiring instructions.

**FIG. 25 – BECKETT BURNER WIRING DIAGRAM
FOR WEATHERPROOF OIL-FIRED BOILER – POOL HEATING**



Gas Burner and Controls Start-Up and Adjustments

WEATHERPROOF BOILERS

This boiler was designed to produce the ultimate in useable heat from the fuel used. To adjust the air-fuel mixture by eye is to waste energy unnecessarily and to create undesirable gases.

Repeat – Do not adjust air by eye. Any time air adjustment or gas rate is changed, combustion **must** be checked with instruments. **CAUTION: A carbon monoxide tester must be used – not a smoke tester.**

Air adjustment is not factory-set. When first firing burner, start with air shutter much nearer closed than final setting anticipated. (At 70 MBH, shutter must be fully closed because some air always bypasses shutter.) With chamber fully warmed up, find highest CO₂ level at which CO of less than 50 ppm can be maintained. Final setting should be at least 10% CO₂. If unable to obtain that reading, check for air leaks, incorrect flame retention head or educator tube not centered. CO₂ readings as high as 11% are acceptable provided CO does not exceed 50 ppm.

The correct input rate is the smallest which will do the job properly. Long continuous runs with minimum starts and stops conserve the most energy. **Caution:** An input rate

that is too low may cause corrosive condensation in boiler and flue.

A PF Series gas boiler ordered individually from the factory is shipped with an Adams burner equipped with the proper flame retention head to match the boiler input rate requested by the purchaser. *However*, burners drawn from a wholesale distributor's stock are shipped with G0 heads, and it is recommended that the installer carry a complete assortment of Adams flame retention heads **in order to change heads when necessary to match the boiler input rate.** When head ratings overlap, a smaller head employed with air shutter fairly well open will generally provide better combustion than a more open head with air shutter near closed.

The information on page 20, an excerpt from the Adams burner instruction booklet, is offered to assist in selecting the correct head and orifice for the Adams gas burner.

CAUTION

Do not use smoke tester with gas burner. Use carbon monoxide tester.

Adams burners supplied from stock with PF Series boilers are equipped with a G0 flame retention head and with two orifice plates, one inserted at each end of the orifice spring. The primary orifice (mounted in position ready for firing) is the smallest at which the burner should be fired using natural gas. The auxiliary orifice (stained red in color) is the smallest at which the burner should be fired with propane. The two orifices are interchangeable according to the fuel to be used, and either should be reamed out if a larger firing rate is desired. Check after reaming with the proper size drill. (See sizing chart on page 20.)

L8151 CONTROL SETTINGS

HiNot less than 200° (20° or more above Lo).

LoNot less than 180° for best tankless output. Lower settings may be used when tankless performance is not a factor. Cold standby is only suitable when thermostatic union (available from Ultimate) is used with a bypass. Call factory for instructions to change wiring.

Diff.20° typical. May be changed to match system.

NOTE: If public utility regulations in your community require labeling of the boiler with burner head size and firing rate, please use label for this purpose enclosed in literature envelope.

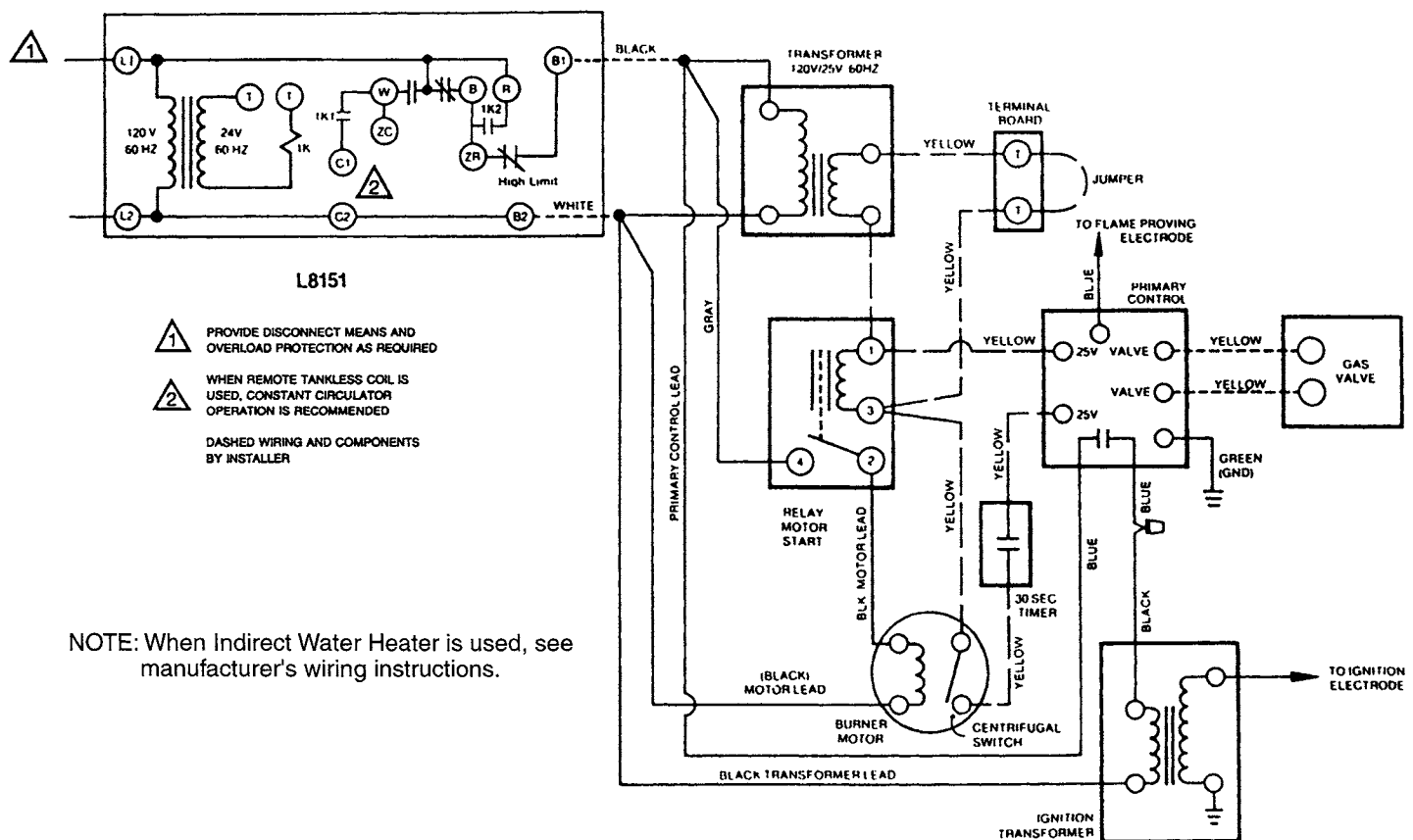
The gas input for natural gas can be determined by timing the gas meter. To vary the gas input, install the nearest size orifice; then adjust the pressure regulator up or down for the exact input desired. The manifold pressure is to be measured at the pressure tap on the gas valve. **NOTE: Do not** exceed the gas valve manufacturer's recommended pressure adjustment range (3" minimum – 4" maximum).

All orifice sizes are approximate. The actual burner input will vary with local heating values supplied.

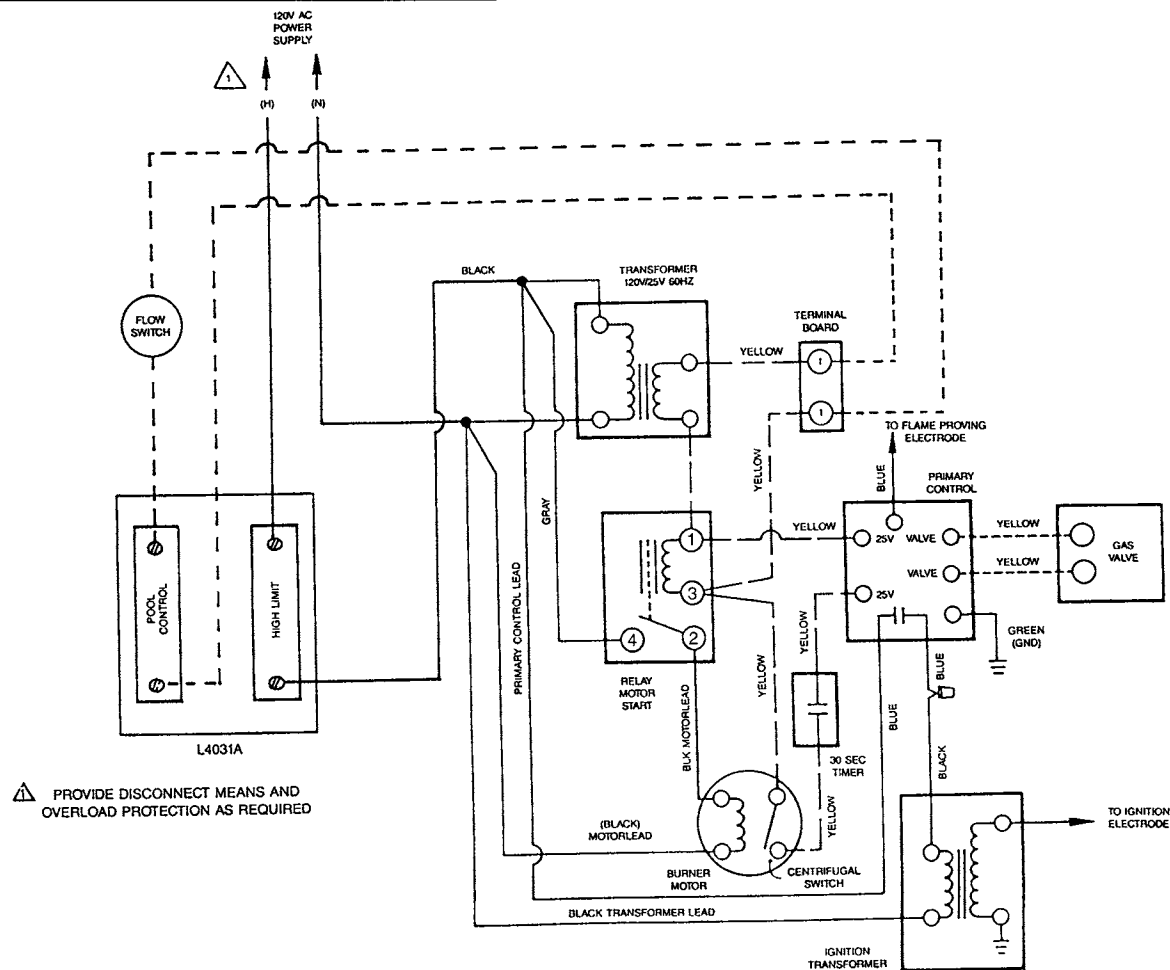
Install, start and adjust burner according to manufacturer's instructions to be found in burner carton.

Complete installation must be made in accordance with the requirements of local authorities and the American Fire Protection Association.

**FIG. 26 – WIRING DIAGRAM
FOR WEATHERPROOF GAS-FIRED BOILER – SPACE HEATING**



**FIG. 27 – WIRING DIAGRAM
FOR WEATHERPROOF GAS-FIRED BOILER – POOL HEATING**



Maintenance

ANNUALLY

To assure trouble-free operation, we recommend that you have the flue passages, burner, combustion chamber, burner adjustment and operation of the controls checked *once each year* by a competent Service Technician.

Before the start of each season (or whenever system has been shut down for some time) recheck the whole system for leaks . . . and recheck the boiler and vent pipe for leaks. Replace or patch any boiler seals that are faulty. Check the silicone rubber seals around the flue collector, between boiler sections, and around the fire door. Ensure that there are no leaks. Use RTV silicone rubber adhesive sealant (available in caulking gun tubes) rated for 400° F to replace or repair seals in locations where original seals have deteriorated.

Flue passages between boiler sections should be examined annually and cleaned if necessary. See cleaning instructions that follow.

VENT PIPE

Visually inspect the entire venting system once a month for any signs of leakage or deterioration. If the vent shows any signs of leaking, replace it immediately.

RELIEF VALVE

Do not connect directly to a drain, but leave an air gap. No shutoff of any description shall be placed between the safety relief valve and the boiler, or on discharge pipes between such safety valves and the atmosphere. Installation of the safety relief valve shall conform to the ANSI/ASME Boiler and pressure Vessel Code, Section IV. The manufacturer is not responsible for any water damage.

This valve should open automatically when the system pressure exceeds the safe limit (30 pounds per square inch). Should it ever fail to open under this condition, shut

down your system. Drain it until pressure is reduced below the safe limit. Then have the valve replaced immediately. The relief valve should be tested monthly. Refer to valve manufacturer's instructions packaged with relief valve.

EXPANSION TANK

This tank may become waterlogged, or may receive an excess of air. Frequent automatic opening of the relief valve indicates water logging. A high boiler temperature accompanied by unusually low radiation unit temperature (and "knocking") indicates excess air in tank.

To correct either condition, close the valve between the boiler and the tank. Drain the tank until it is empty. Check all the tank plugs and fittings. Tighten as necessary. Open the valve between the boiler and tank. Water will rise to the normal height in the tank if you have an automatic fill valve (otherwise, manually refill the system).

WATER SYSTEM

If system is to remain out of service during freezing weather and does not contain antifreeze, always **drain it** completely (water left in to freeze will crack the pipes and/or boiler).

ANTIFREEZE

Where used, the antifreeze solution must be checked at least once a year in the manner recommended by the manufacturer of the antifreeze. The antifreeze includes a corrosion inhibitor that can become depleted in time, causing the solution to become corrosive. It is important that this be checked and the inhibitor be replenished or the system be refilled with fresh antifreeze solution, whichever may be required.

Antifreeze must be non-toxic, and of a type specifically intended for use in closed hydronic heating systems. Under no circumstances should automotive antifreeze be used.

TANKLESS COIL GASKET

The tankless coil gasket should be checked at least twice a year, for leakage, and replaced if necessary.

OIL BURNER MAINTENANCE

The following preventive maintenance items should be performed annually, preferably prior to the heating season.

1. OIL BURNER MOTOR – Add two-three drops of non-detergent electric motor oil to each oil cup located at

the front and rear of the motor. Excessive oiling will shorten the life expectancy of the motor.

2. FUEL FILTER – This should be replaced so as to prevent contaminated fuel from reaching the nozzle. A partially blocked fuel filter can cause premature failure of the fuel pump unit.
3. FUEL PUMP UNIT – Replace pump screen and clean pump unit to maintain reliable fuel delivery to the nozzle.
4. IGNITION ELECTRODES – Clean and adjust as per manufacturer's recommendations, so as to maintain reliable ignition of the oil.
5. NOZZLE – Replace so as to maintain safe and reliable combustion efficiency.
6. FAN AND BLOWER HOUSING – These must be kept clean, free of dirt, lint and oil so as to maintain the proper amount of air the fuel requires to burn.

GAS BURNER MAINTENANCE

The following preventive maintenance items should be performed annually, preferably prior to the heating season.

1. GAS BURNER MOTOR – Add two-three drops of non-detergent electric motor oil to each oil cup located at the front and rear of the motor. Excessive oiling will shorten the life expectancy of this motor.
2. IGNITION ELECTRODES – Check burner head, ignition electrode and flame rod for proper condition and alignment. Adjust per manufacturer's recommendations, so as to maintain reliable ignition and flame proving.
3. FAN AND BLOWER HOUSING – These must be kept clean, free of dirt and lint so as to maintain the proper amount of air that the fuel requires to burn cleanly.

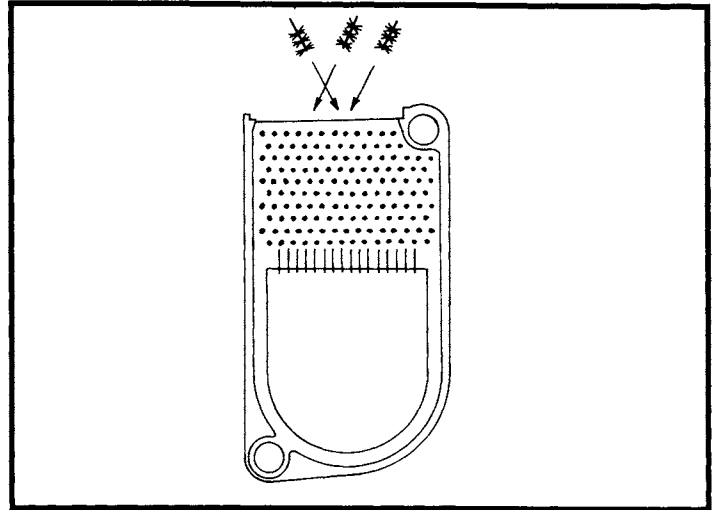
NOTE: If any component parts must be replaced, always use parts recommended by the burner manufacturer.

After re-assembling the burner, perform complete combustion tests using combustion test instruments.

Never burn garbage or paper in the unit, and never leave combustible material around it.

Boiler Cleaning Instructions

1. Shut off all electrical power to the boiler/burner and shut off fuel supply.
2. Remove the sheet metal smoke pipe from the top of the boiler. Inspect pipe and chimney for signs of corrosion and deterioration. Clean base of chimney.
3. Remove relief valve discharge pipe and top jacket panel.
4. Remove the two brass wing nuts holding the flue collector top. Remove the collector top.
5. Check the gasket on the underside of the flue collector and replace as necessary.
6. Remove the burner. Service burner per burner manufacturer's instructions.
7. Inspect the combustion chamber and fire door insulation for cracking and deterioration. If there is any signs of cracking or deterioration, replace before reassembling the boiler.
8. Remove soot from fireside surfaces by brushing diagonally through the flue passages (see drawing). Care should be taken so as not to damage the combustion chamber with the flue brush.
9. Reinstall the burner.
10. Reinstall the flue collector top and secure with the two brass wing nuts.



11. Reinstall the top jacket panel. Reconnect the flue pipe. Reinstall relief valve discharge pipe.
12. Reconnect the electrical and fuel supplies.
13. Fire the burner, checking for proper combustion using combustion test equipment, making adjustments as necessary.
14. Insure that all safety controls and operating controls are functioning properly.

IMPORTANT OPERATING AND MAINTENANCE REQUIREMENTS

KEEP YOUR BOILER AND THE AREA AROUND IT CLEAN

**NEVER BURN REFUSE OR ANY MATERIAL OTHER THAN
THE SPECIFIED FUEL IN YOUR BOILER**

HAVE YOUR BOILER CHECKED EACH YEAR BY A QUALIFIED TECHNICIAN

Service Hints

You may avoid inconvenience and service calls by checking these points before you call for service.

IF YOUR SYSTEM IS NOT HEATING OR NOT GIVING ENOUGH HEAT . . .

Possible Cause	What to do
Thermostat is not set correctly	Reset thermostat above room temperature.
Boiler and/or Burner may be dirty	Clean all flue passages and the vent pipe. Have burner cleaned and readjusted.
Burner may not be firing at proper rate	Check nozzle size or orifice size if there is any doubt. Have burner adjusted.
Burner may be short-cycling	Short-cycling (too frequent off and on) of burner will cause sooting. If boiler and/or burner become dirty at frequent intervals, after correcting the "dirt condition" also correct the control setting (or other cause of the short-cycling). Check thermostat heat anticipator and correct setting, if necessary per instruction sheet packed with thermostat.
No power to boiler	Check overcurrent protection. Check to be sure power supply circuit is "ON."
Controls out of adjustment	Reset according to instructions packed with controls.
Radiators not heating	Open radiator vents to vent excess air. Check flow control valve (if used). It may be in closed position.
Circulating pump not running	Check relay operation.
Poor electrical contact	Check all control terminals and wire joints.

IF BURNER IS NOISY . . .

Possible Cause	What to do
Burner fan wheel may be dirty	Clean fan wheel with a stiff brush and cleaning solvent. Readjust burner.
Draft regulator may be stuck (where applicable)	Check to see if vane swings freely. Clean, if vane is stuck.

IF RADIATORS ARE NOISY . . .

Possible Cause	What to do
Air in system	Open radiator vents to vent air. Check expansion tank.

RELIEF VALVE LEAKING . . .

Possible Cause	What to do
Dirt on seat	Open valve manually. Allow water to run and clear valve seat.
Water logged expansion tank	Drain tank, see instructions.

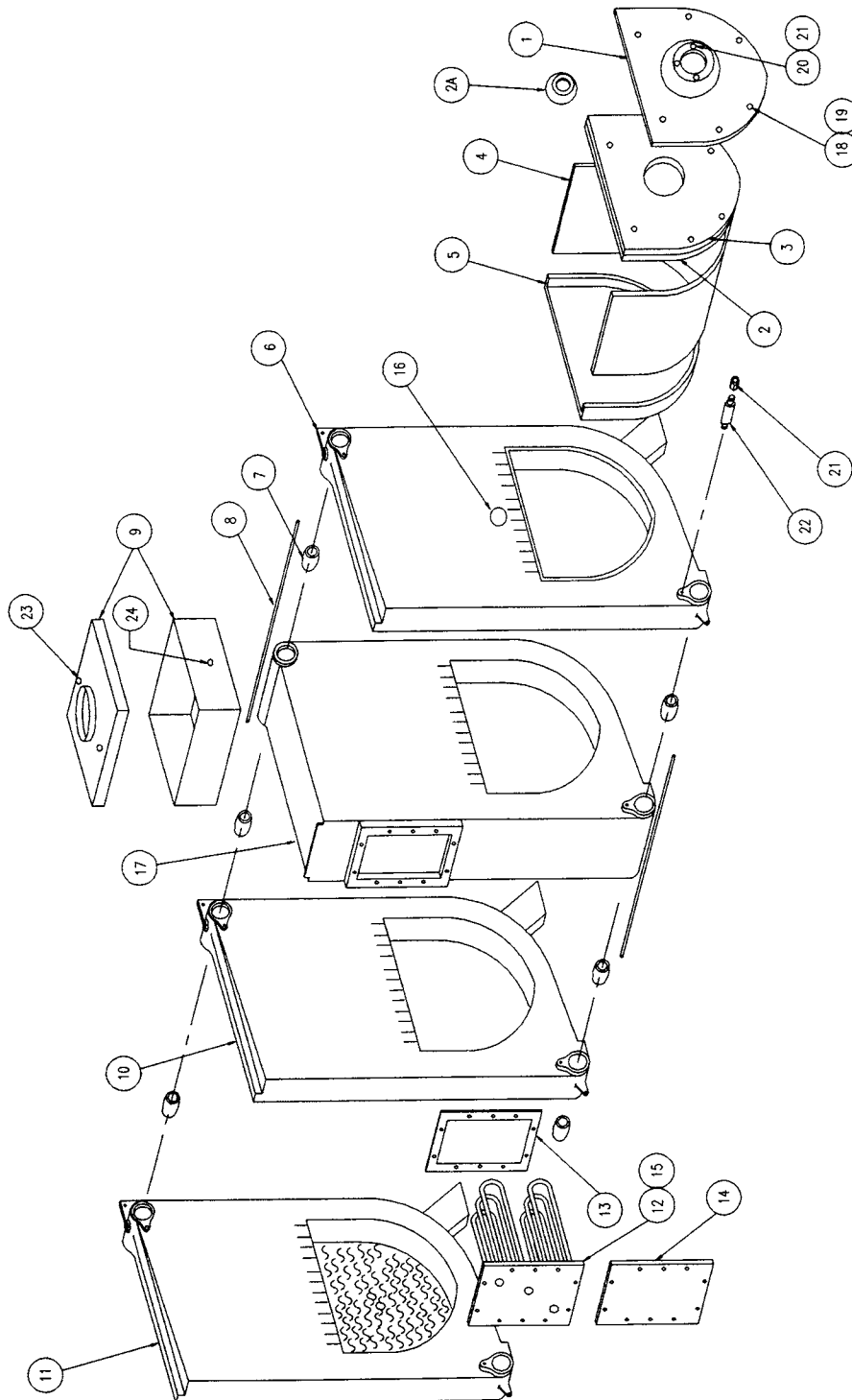
HAVE YOUR SERVICE TECHNICIAN CHECK ANY PROBLEM YOU ARE UNABLE TO CORRECT.

Repair Parts

IMPORTANT – READ THESE INSTRUCTIONS BEFORE ORDERING

All parts listed in the following Parts List may be ordered through your nearest supplier.

When ordering parts, first obtain the Model Number from the data plate on your boiler, then determine the Part No. (not the Key No.) and the Description of each part from the following illustrations and list. Be sure to give us all this information: The Part No. – The Part Description – The Boiler Model No.

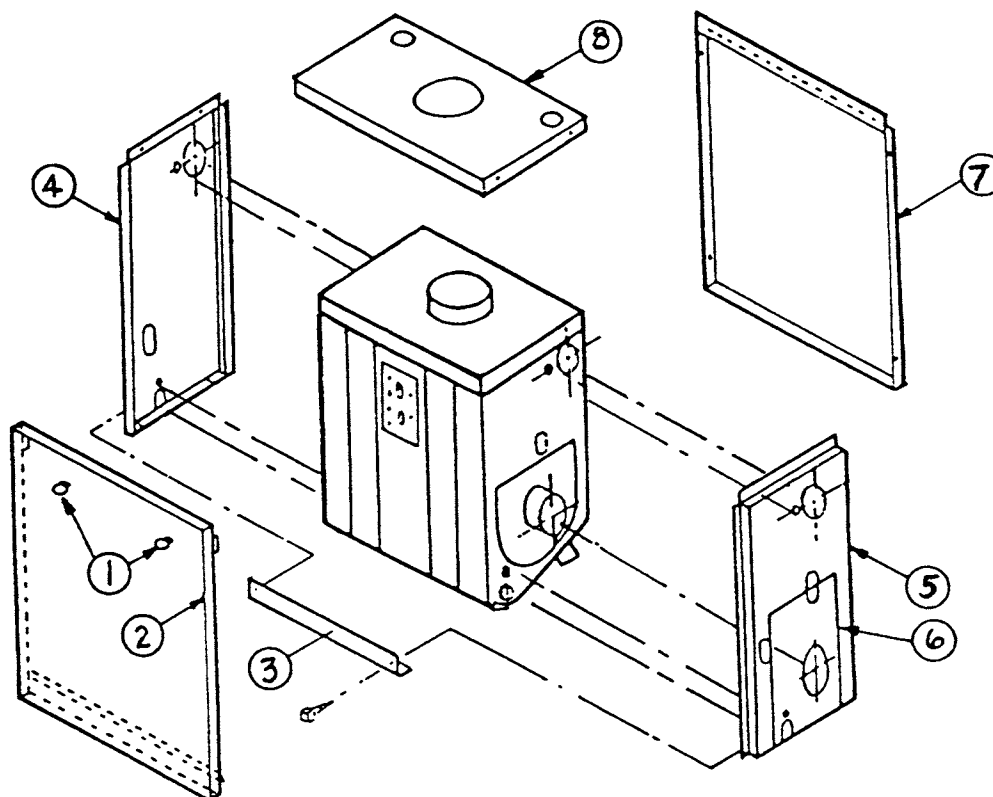


BOILER PARTS

THIS IS A REPAIR PARTS LIST - NOT A PACKING LIST

KEY NO.	MODEL 3	MODEL 3T	MODEL 4	MODEL 4T	MODEL 5	MODEL 5T	MODEL 6T	MODEL 7	MODEL 7TT	MODEL 8T	MODEL 9	DESCRIPTION
1	419-82-002	419-82-001	419-82-001	419-82-001	419-82-001	419-82-001	419-82-001	419-82-001	419-82-001	419-82-001	419-82-001	Fire Door
2	—	146-30-021	146-30-021	146-30-021	146-30-021	146-30-021	146-30-021	146-30-021	146-30-021	146-30-021	146-30-021	Front Chamber
2A	146-30-025	—	—	—	—	—	—	—	—	—	—	Cone Chamber
3	146-30-024	146-30-022	146-30-022	146-30-022	146-30-022	146-30-022	146-30-022	146-30-022	146-30-022	146-30-022	146-30-022	Front Plate
4	146-30-031	146-30-031	146-30-031	146-30-031	146-30-031	146-30-031	146-30-031	146-30-031	146-30-031	146-30-031	146-30-031	Durablanket
5	146-30-023	146-30-023	146-30-023	146-30-023	146-30-023	146-30-023	146-30-023	146-30-023	146-30-023	146-30-023	146-30-023	Rear Chamber
6	419-00-001	419-00-001	419-00-001	419-00-001	419-00-001	419-00-001	419-00-001	419-00-001	419-00-001	419-00-001	419-00-001	Front Section
7	433-00-976	433-00-976	433-00-976	433-00-976	433-00-976	433-00-976	433-00-976	433-00-976	433-00-976	433-00-976	433-00-976	Push Nipples
8	146-05-044	HW-011.01	HW-011.01	146-05-003	146-05-003	146-05-054	146-05-005	146-05-005	146-05-009	146-05-009	146-05-009	Tie Rods
9	425-82-131	425-82-121	425-82-121	425-82-122	425-82-122	425-82-123	425-82-124	425-82-124	425-82-125	425-82-125	425-82-125	Flue Collector
10	419-00-002	—	419-00-002	419-00-002	419-00-002	419-00-002	419-00-002	419-00-002	419-00-002	419-00-002	419-00-002	Middle Section
11	419-00-003	419-00-003	419-00-003	419-00-003	419-00-003	419-00-003	419-00-003	419-00-003	419-00-003	419-00-003	419-00-003	Back Section
12A	—	146-27-023	—	146-27-023	—	146-27-023	146-27-023	—	146-27-023	146-27-023	—	Tankless Coil — Single Pass
†	—	433-82-255	—	433-82-255	—	433-82-255	433-82-255	—	433-82-255	433-82-255	—	Tankless Coil Kit — Single Pass (Includes 12A, 13 and 15)
12B	—	146-27-022	—	146-27-022	—	146-27-022	146-27-022	—	146-27-022	146-27-022	—	Tankless Coil — Two Pass
†	—	433-82-259	—	433-82-259	—	433-82-259	433-82-259	—	433-82-259	433-82-259	—	Tankless Coil Kit — Two Pass (Includes 12B, 13 and 15)
13	—	146-93-065	—	146-93-065	—	146-93-065	146-93-065	—	146-93-065	146-93-065	—	Tankless Coil Gasket
14	—	146-19-001	—	146-19-001	—	146-19-001	146-19-001	—	146-19-001	146-19-001	—	Blank Coil Plate
15A	—	146-95-113	—	146-95-113	—	146-95-113	146-95-113	—	146-95-113	146-95-113	—	3/8" - 16 x 1-1/2" SS Stud (10 req'd)
15B	—	1330008	—	1330008	—	1330008	1330008	—	1330008	1330008	—	Nut Hex Serrated 3/8"-16 S.S.
16	433-82-251	433-82-251	433-82-251	433-82-251	433-82-251	433-82-251	433-82-251	433-82-251	433-82-251	433-82-251	433-82-251	Sight Glass Assembly
17	—	419-00-004	—	419-00-004	—	419-00-004	419-00-004	—	419-00-004	419-00-004	—	Coil Section
18	HW06701	HW06701	HW06701	HW06701	HW06701	HW06701	HW06701	HW06701	HW06701	HW06701	HW06701	5/16" x 1-5/8" Stud (Firedoor - 6 req'd)
19	1330007	1330007	1330007	1330007	1330007	1330007	1330007	1330007	1330007	1330007	1330007	5/16" Hex Nut (Firedoor - 6 req'd)
20	HW07001	HW07001	HW07001	HW07001	HW07001	HW07001	HW07001	HW07001	HW07001	HW07001	HW07001	5/16" x 1-3/8" Stud (Burner - 3 req'd)
21	146-95-042	146-95-042	146-95-042	146-95-042	146-95-042	146-95-042	146-95-042	146-95-042	146-95-042	146-95-042	146-95-042	5/16" Acron Nut (7 req'd)
22	146-95-103	146-95-103	146-95-103	146-95-103	146-95-103	146-95-103	146-95-103	146-95-103	146-95-103	146-95-103	146-95-103	Jacket Standoff (4 req'd)
23	137-04-007	137-04-007	137-04-007	137-04-007	137-04-007	137-04-007	137-04-007	137-04-007	137-04-007	137-04-007	137-04-007	# 8 - 32 Brass Wing Nuts (2 req'd)
24	146-95-109	146-95-109	146-95-109	146-95-109	146-95-109	146-95-109	146-95-109	146-95-109	146-95-109	146-95-109	146-95-109	# 14 - 1" Sheet Metal Screw
†	433-82-261	433-82-262	433-82-262	433-82-263	433-82-263	433-82-264	433-82-265	433-82-265	433-82-266	433-82-266	433-82-266	Combustion Chamber Replacement Kit (Includes Items 2 or 2A, 3, 4 and 5)

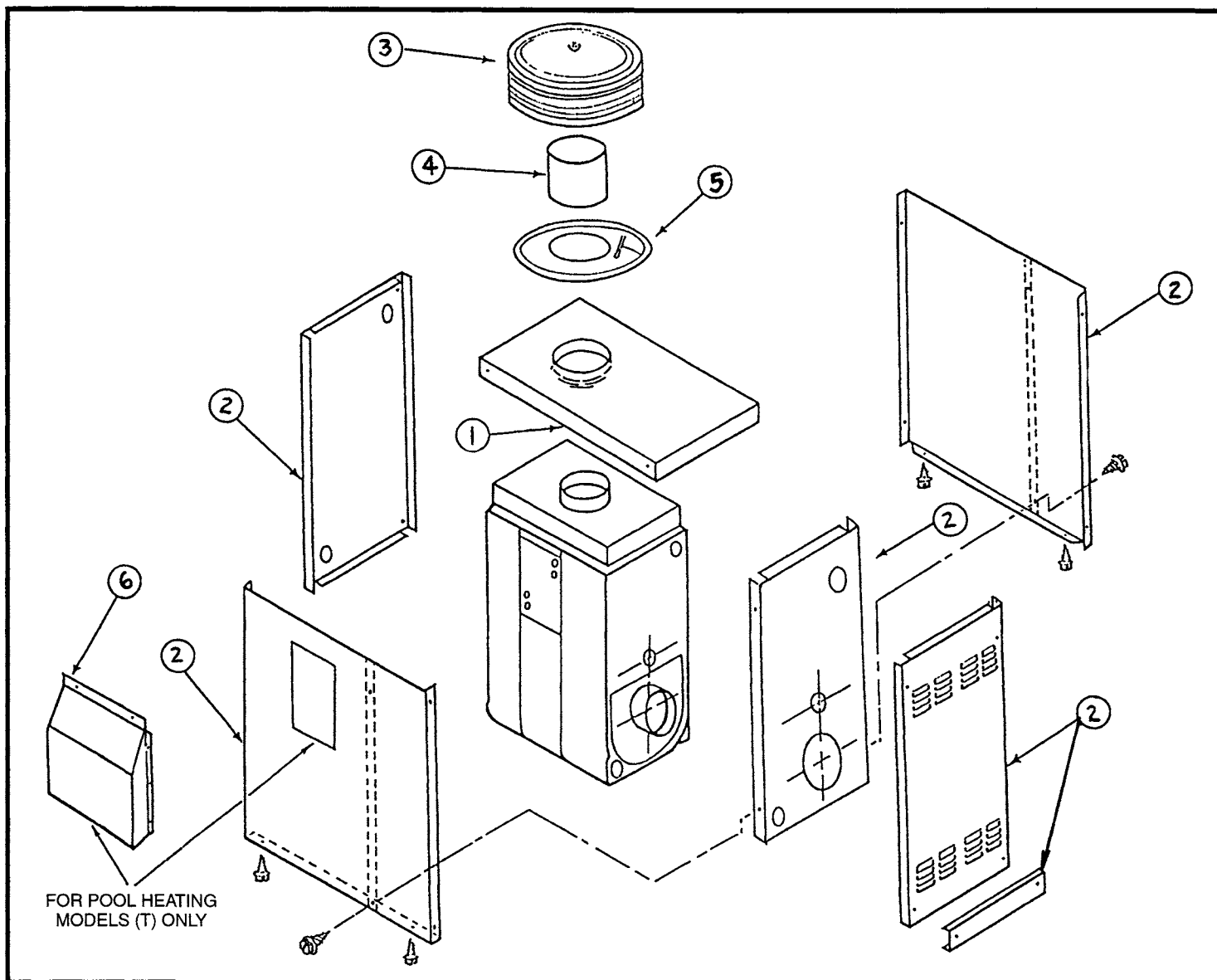
Repair Parts



INDOOR JACKET PARTS

KEY NO.	MODEL 3	MODEL 3T, 4	MODEL 4T, 5	MODEL 5T	MODEL 6T, 7	MODEL 7TT, 8T, 9	DESCRIPTION
1	137-02-153	137-02-153	137-02-153	137-02-153	137-02-153	137-02-153	Knob Set
2	425-82-049	425-82-044	425-82-045	425-82-046	425-82-047	425-82-048	Jacket Door
3	425-00-653	425-00-654	425-00-655	425-00-656	425-00-657	425-00-659	Tie Bar
4	425-82-030	425-82-030	425-82-030	425-82-030	425-82-030	425-82-030	Left Side Jacket Panel
5	425-82-028	425-82-031	425-82-031	425-82-031	425-82-031	425-82-031	Right Side Jacket Panel
6	425-82-029	425-82-032	425-82-032	425-82-032	425-82-032	425-82-032	Right Side Cover Plate
7	425-82-038	425-82-033	425-82-034	425-82-035	425-82-036	425-82-037	Back Panel
8	425-82-065	425-82-060	425-82-061	425-82-062	425-82-063	425-82-064	Top Panel
—	742-83-1003	742-83-1004	742-83-1005	742-83-1006	742-83-1007	742-83-1009	Complete Jacket

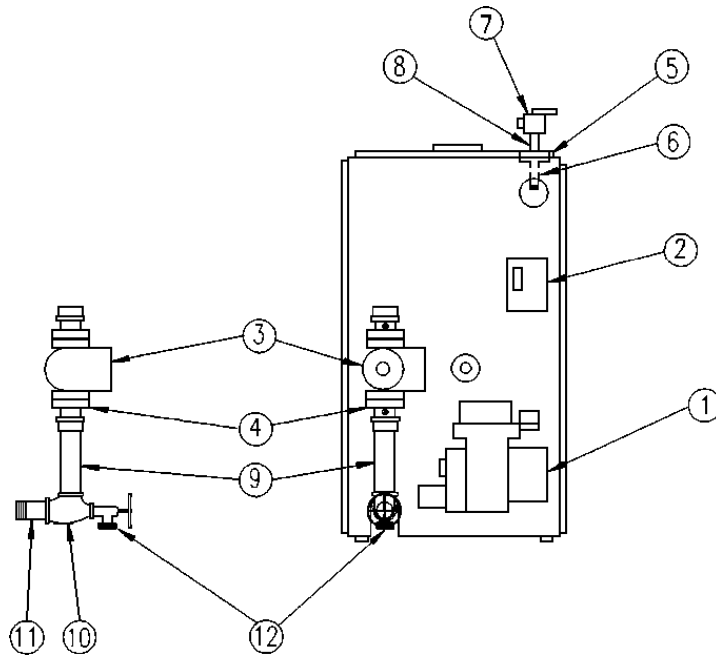
Repair Parts



WEATHERPROOF JACKET PARTS

KEY NO.	MODEL 3TW, 4W	MODEL 6TW, 7W	MODEL 7TTW, 8TW, 9W	DESCRIPTION
1	146-30-411	146-30-412	146-30-413	Top Panel
2	146-30-402	146-30-403	146-30-404	Jacket
3	146-30-421	146-30-424	146-30-427	Weather Shield
4	146-30-423	146-30-426	146-30-429	Flue Pipe
5	146-30-422	146-30-425	146-30-428	Collar
6	146-30-401	146-30-401	146-30-401	Weatherproof Coil Housing

Repair Parts

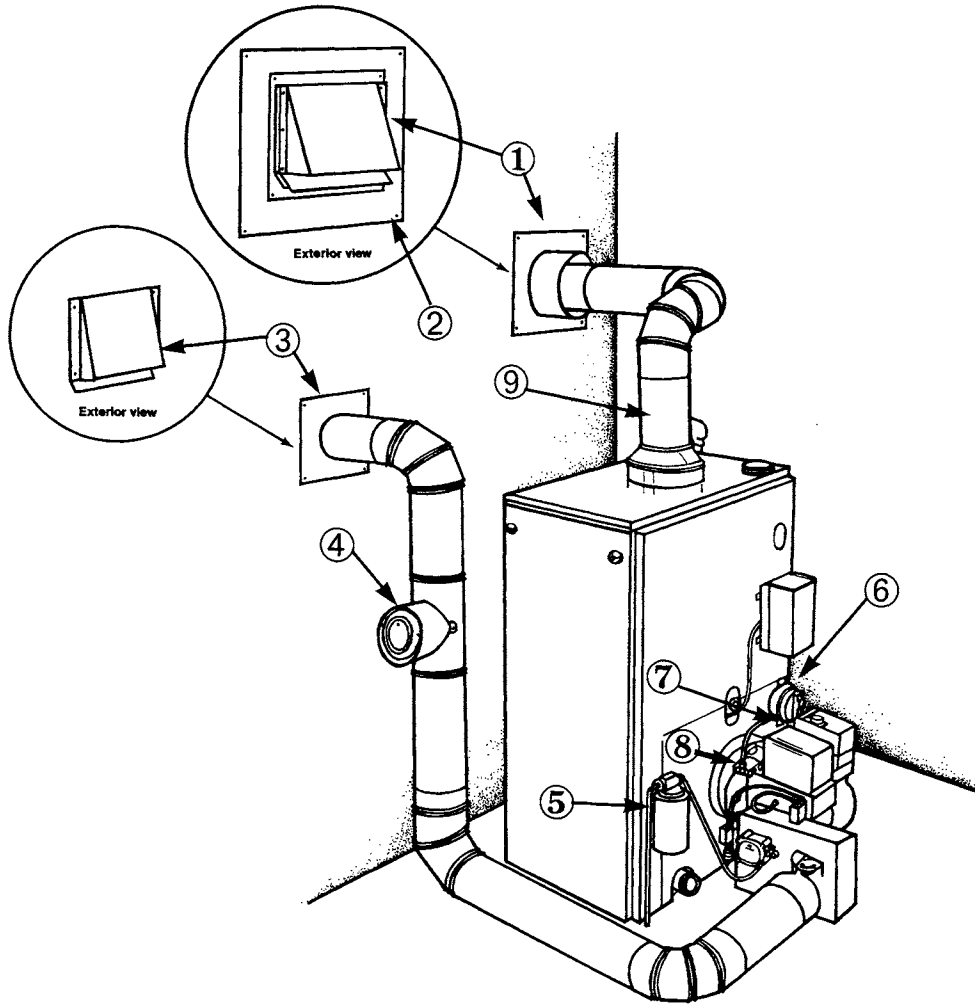


BOILER CONTROLS AND PIPING

KEY NO.	PART NO.	DESCRIPTION
1	146-19-201	Beckett AFG Standard Oil Burner (2.00 gph or less)
1	BN08901	Beckett CF375 Standard Oil Burner (2.00 gph or more)
1	1050006	Riello 40 F5 Standard Oil Burner (0.90 to 1.50 gph)
1	146-19-011	Riello 40 F10 Standard Oil Burner (1.60 to 3.00 gph)
1	146-19-202	Beckett AFG Post Purge Oil Burner (2.00 gph or less)
1	146-30-250	Adams G2T Gas Burner Less Head
2	146-62-201	L8151A1045 Triple Acting Aquastat
3	CI-001.03	Taco 007 Circulator (Except Models 7TT, 8T, 9)
3	146-26-062	Taco 0012 Circulator (Models 7TT, 8T, 9)
4	146-26-043	1-1/4" Taco Isolation Valves
4	146-26-063	1-1/2" Flanges
5	1260006	Temperature Pressure Gauge
6	1060002	3/4" x 1/4" Bushing
7	146-22-011	3/4" ASME Relief Valve
8	146-07-202	3/4" x 4-1/2" Nipple
9	146-07-012	1-1/4" x 10" Nipple (Except Models 7TT, 8T, 9)
9	146-07-206	1-1/2" x 12" Nipple (Models 7TT, 8T, 9)
10	151-00-01	1-1/4" x 3/4" x 1-1/4" Tee (Except Models 7TT, 8T, 9)
10	151-00-02	1-1/2" x 3/4" x 1-1/2" Tee (Models 7TT, 8T, 9)
11	146-07-044	1-1/4" x 2-1/2" Nipple (Except Models 7TT, 8T, 9)
11	1310005	1-1/2" x 2-1/2" Nipple (Models 7TT, 8T, 9)
12	146-22-000	3/4" Boiler Drain Valve
†	146-93-204	1-1/2" x 1-1/4" Bushing (Except Models 7TT, 8T, 9)
†	146-30-020	Immersion Well fo Aquastat
†	146-93-201	11/2" x 3/4" Bushings
†	1395005	1-1/2" Sq. Hd. Plugs
†	146-06-020	400°F Black Silicone Rubber Adhesive Sealant (10.3 oz. cartridge)
†	1460001	500°F Red Silicone Rubber Adhesive Sealant (10.3 oz. cartridge)

† - Not Pictured

Repair Parts



DIRECT EXHAUST SYSTEM PARTS

KEY NO.	PART NO.	DESCRIPTION
1	146-30-011	4" Stainless Steel Exhaust Hood
1	146-30-012	6" Stainless Steel Exhaust Hood
2	146-30-013	18" x 18" Stainless Steel Wall Plate
3	146-30-015	4" Air Inlet Hood (Includes Item 4)
4	-	Vacuum Relief Draft Regulator (Included with Item 3)
5	146-30-016	GAR-BER 11VR Spin On Filter Assembly
6	146-30-007	FP 4313 Pressure Switch
7	146-30-014	1/4" x 12" Copper Tube
8	146-30-008	Brass Compression Tee
9	146-30-009	4" Clamp
9	146-30-010	6" Clamp

SUGGESTED NOZZLES AND SETTINGS FOR BECKETT AFG AND CF375 OIL BURNER SERIES

MODEL	RATE	NOZZLE	HEAD-ADJ.	LOW FIRE BAFFLE	AIR SHUTTER	AIR BAND	OIL BURNER
DPFO-3	.65	.60-80°A	F 0 - 1 1/8	Yes	10	1	AFG
	.75	.65-70°A	F 0 - 1 1/8	No	10	0	AFG
	.90	.75-80°B	F 3 - 1 1/8	No	10	0	AFG
DPFO-4	.65	.60-80°A	F 0 - 1 1/8	Yes	10	1	AFG
	.90	.75-80°A	F 3 - 1 1/8	No	10	0	AFG
	1.35	1.20-80°B	F 6 - 1 1/8	No	10	2	AFG
DPFO-5	.75	.65-80°A	F 3 - 1 1/8	Yes	10	1	AFG
	1.10	1.00-80°A	F 6 - 1 1/8	No	10	1	AFG
	1.70	1.50-80°A	F12 - 1 1/8	No	10	3	AFG
DPFO-7	1.00	.90-80°B	F 3 - 1 1/8	No	10	0	AFG
	1.60	1.35-80°B	F12 - 1 1/8	No	10	1	AFG
	2.35	2.00-60°B	SV1 - # 3	No	10	2.5	CF375
DPFO-9	1.35	1.20-70°A	F 6 - 1 1/8	No	10	2	AFG
	2.00	1.65-40°B	SV1 - # 1	Yes*	6.5	0	CF375
	3.00	2.50-60°B	SV1 - # 5	Yes*	10	4	CF375
DPFO-3T	.65	.60-80°A	F 0 - 1 1/8	Yes	10	2	AFG
	.85	.75-80°A	F 3 - 1 1/8	No	10	1	AFG
	1.10	.90-80°B	F 3 - 1 1/8	No	10	1	AFG
DPFO-4T	.65	.60-80°B	F 0 - 1 1/8	Yes	10	1	AFG
	1.00	.85-80°B	F 3 - 1 1/8	No	10	1	AFG
	1.45	1.25-80°B	F 6 - 1 1/8	No	10	2	AFG
DPFO-5T	.80	.65-70°A	F 3 - 1 1/8	Yes	10	0	AFG
	1.20	1.00-70°A	F 6 - 1 1/8	No	10	1	AFG
	1.75	1.50-70°A	F12 - 1 1/8	No	10	3	AFG
DPFO-6T	.95	.85-80°B	F 3 - 1 1/8	No	10	2	AFG
	1.45	1.20-80°B	F 6 - 1 1/8	No	10	3	AFG
	2.10	1.75-60°B	SV1 - # 2	Yes*	10	0	CF375
DPFO-8T	1.25	1.00-70°A	F 6 - 1 1/8	No	10	6	AFG
	1.90	1.50-60°B	SV1 - # 1	Yes*	6	0	CF375
	2.75	2.25-60°B	SV1 - # 5	Yes*	10	3	CF375

Pump pressure is set at 140 psig.
All burners fired at +.01 to +.1 inches w.c. draft over fire

*CF375 - Low fire baffle different from AFG

NOTE: These settings are intended for initial start up *only*. Final adjustment must be made using combination test instruments

SUGGESTED NOZZLES AND SETTINGS FOR RIELLO R40 OIL BURNER SERIES

BOILER MODEL	NOZZLE	ACTUAL INPUT RATE (gph)	PUMP PRESSURE (psig)	TURBULATOR SETTING	AIR GATE SETTING	OIL BURNER MODEL
PFO-3	0.50-60°A	0.65	170	0.5	3.40	F3
	0.60-60°A	0.75	155	1.5	3.75	F3
	0.75-60°A	0.90	150	3.0	5.00	F3
	0.75-60°W	0.90	150	3.0	5.00	F5
PFO-4	0.50-60°W	0.65	170	0.5	3.40	F3
	0.85-60°W	1.00	150	2.0	3.25	F5
	1.10-60°W	1.35	150	3.5	4.50	F5
PFO-5	0.60-60°W	0.75	155	0.5	2.25	F5
	0.85-60°W	1.10	170	2.0	3.00	F5
	1.35-60°W	1.70	160	1.5	3.00	F10
PFO-7	0.85-60°W	1.00	160	2.0	3.20	F5
	1.35-60°W	1.60	175	3.0	1.50	F10
	2.00-60°W	2.35	160	4.0	3.50	F10
PFO-9	1.10-60°W	1.35	165	3.5	3.80	F5
	1.65-60°W	2.00	165	2.5	3.40	F10
	2.50-60°B	3.00	150	5.0	7.80	F10
PFO-3T	0.50-60°W	0.65	170	0.5	3.10	F3
	0.75-60°W	0.95	160	3.0	4.5	F3
	0.75-60°W	0.95	160	3.0	4.5	F5
	0.85-60°W	1.10	170	2.0	3.10	F5
PFO-4T	0.50-60°W	0.65	170	0.5	3.40	F3
	0.75-60°A	0.95	160	3.0	4.50	F3
	1.20-60°A	1.45	150	4.0	4.30	F5
PFO-5T	0.60-60°A	0.80	175	1.0	2.30	F5
	1.25-60°A	1.50	150	4.0	5.50	F5
	1.35-60°A	1.75	170	1.5	3.20	F10
PFO-6T	0.75-60°W	0.95	175	1.5	2.80	F5
	1.20-60°W	1.45	170	3.5	5.00	F5
	1.75-60°W	2.10	170	2.5	4.50	F10
PFO-8T	1.00-60°W	1.25	175	2.5	4.00	F5
	1.50-45°W	1.90	175	2.0	3.40	F10
	2.25-45°B	2.75	175	5.0	6.00	F10

1. All burners fired at an over fire pressure of +0.02" wc.
2. Burner insertion depth was 4-5/8"
3. The Riello 40 F3 burner is not available through Dunkirk Radiator Corporation

NOTE: These settings are intended for initial start up only. Final adjustment must be made using combustion test instruments.

